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ANNUAL REPORT

OF THE

OHIO ACADEMY OF SCIENCE

Forty-ninth Meeting

1939

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THE OHIO ACADEMY OF SCIENCE

Organized 1891 Incorporated 1892
Affiliated with the American Association for the Advancement of Science

OFFICERS AND COMMITTEES FOR 1939–1940

President
WILLIAM LLOYD EVANS

Director for Semi-Centennial, 1940
DEAN GEORGE F. ARPS

Vice-Presidents

A. *Zoology:* JOHN W. PRICE
B. *Botany:* MISS LOIS LAMPE
C. *Geology:* OTTO C. VON SCHLICTEN
D. *Medical Sciences:* GEORGE M. CURTIS
E. *Psychology:* FLOYD C. DOCKERAY
F. *Physics and Astronomy:* RAY LAMBERT
G. *Geography:* GEORGE D. HUBBARD
H. *Chemistry:* PAUL ROTHEMUND
I. *Mathematics:* LEWIS BRAND

Secretary
WILLIAM H. ALEXANDER

Treasurer
EUGENE VAN CLEEF

Executive Committee
Ex-Officio: WM. LLOYD EVANS, WM. H. ALEXANDER, EUGENE VAN CLEEF
Elective: CLAUDE E. O'NEAL AND J. PAUL VISSCHER

Trustees Research Fund
HERBERT OSBORN, *Chairman*, term expires.....1941
JAMES P. PORTER, term expires.....1940
CHARLES G. SCHATZER, term expires.....1942

Library Committee
MRS. ETHEL M. MILLER, *Chairman*,
In charge of Academy Exchanges and Publications
GEORGE D. HUBBARD, term expires.....1940
E. LUCY BRAUN, term expires.....1941

Academy Representatives
(1) On Joint Administrative Board, O. J. S.:
WALTER H. BUCHER, term expires.....1940
A. W. LINDSEY, term expires.....1941
(2) On Council of A. A. A. S.....WILLIAM H. ALEXANDER
(3) On Save Outdoor Council.....ROSCOE W. FRANKS

Committee on Conservation
A. E. WALLER, *Chairman*, term expires.....1942
F. H. KRECKER, term expires.....1940
W. E. STOUT, term expires.....1940
WALTER A. TUCKER, term expires.....1940
G. W. CONREY, term expires.....1941
E. L. WICKLIFF, term expires.....1941
PAUL B. SEARS, term expires.....1941
EMERY R. HAYHURST, term expires.....1942
L. E. HICKS, term expires.....1942

Nominating Committee for 1940

A. ROBERT A. HEFNER
B. PAUL B. SEARS
C. W. STORRS COLE
D. LINDEN F. EDWARDS, *Chairman*
E. JAMES R. PATRICK
F. LEON E. SMITH
G. FRED A. CARLSON
H. HARVEY V. MOYER
I. CARL VER STEEG

REPORT OF THE FORTY-NINTH ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

WILLIAM H. ALEXANDER,
Secretary

The Forty-ninth Annual Meeting of the Ohio Academy of Science, held on the campus of the University of Cincinnati, Cincinnati, Ohio, on April 14–15, 1939, formed a very appropriate climax to the vigorous, aggressive administration of President Claude E. O'Neal, of Ohio Wesleyan University, Delaware, Ohio. Although the weather was persistently unfavorable throughout the entire meeting, the attendance was good and the enthusiasm notably fine. The committee in charge of the local arrangements, under the untiring, watchful leadership of Prof. J. Hobart Hoskins, apparently anticipated the many needs of the academy and the several sections down to the smallest detail and made ample provision for all. But what else was to be expected of the University of Cincinnati! Few, if any, institutions are better equipped for just such service than said University of Cincinnati! Again, "a thousand thanks, and we are much obliged besides!"

Under the skillful leadership of the President, the business portion of the meeting was limited to one session, held in the auditorium of McMicken Hall, on Friday morning. A fairly complete stenographic report of this meeting was made and is on file with the secretary, but for economic reasons only the chief items of business transacted are given below.

I. The President announced the following committee appointments:

1. *Resolutions*—ARTHUR T. EVANS, Chairman; CLYDE S. ADAMS, RODERICK PEATTIE.
2. *Necrology*—A. E. WALLER, Chairman; FRANCIS H. HERRICK.

II. Reports of Officers:

The President made a brief oral report; the Secretary and Treasurer made written reports.

III. Reports of Committees:

Under this heading written reports were submitted by the Executive Committee, the Board of Trustees, the Joint Administrative Board, Ohio Journal of Science, the Library Committee, the Committee on Co-operation with the State Department of Education, the Committee on Conservation,

the Committee on the Revision of the Constitution and By-Laws, Necrology, and Resolutions, all of which are printed elsewhere in the proceedings.

IV. *At the Banquet:*

Departing slightly from custom, the Committee on the Election of Fellows and the Nominating Committee made their reports at the conclusion of the Friday evening banquet. (Printed elsewhere.) Also voted unanimously in favor of the report of the Committee on Revision of the Constitution and By-Laws. That the report of the Nominating Committee be approved and the persons mentioned therein be declared elected.

V. *Other Motions Passed:*

1. To approve the recommendations made by the Committee on Conservation. (See report of the committee published elsewhere.)
2. To postpone action on the revised constitution from the morning business session to the evening session.
3. To approve the report of the Committee on Co-operation with the State Department of Education, and to continue the committee for another year.
4. That the Secretary, Wm. H. Alexander, be the Academy representative on the Council of the American Association for the Advancement of Science and at the Academy Conference for the 1939 meeting of these organizations at Columbus, Ohio.
5. That the vice-presidents of 1939 constitute the Nominating Committee for 1940.

VI. *Membership Campaign Approved:* "One Thousand Members by 1940."

In presenting the report of the Membership Committee, Dr. C. W. Jarvis, its chairman, spoke as follows regarding the Membership Committee and its plans for an intensive drive for new members during the ensuing year:

"All of the committee have a very definite feeling that if the program of the committee is extended and broadened, we shall have no difficulty in securing one thousand members by 1940. The members of the committee have the feeling also that the activities of the Academy might well be extended and intensified along certain lines. When a man signs a membership card, he feels very definitely that he should know where his $2.50 is to go and what he is to receive for it. Most of us know that $1.50 goes to pay for the *Journal*, and many scientists feel that the *Journal* should be broadened. Most sciences have other technical avenues for education; the physics people, for example, have their journals; the chemists and the mathematicians have their publications. Many lovers

of science feel that a good deal of important information regarding science, state news items, abstracts, etc., should be included in the *Ohio Journal of Science.* We hope, therefore, that those who have control of the *Journal* will widen its influence and usefulness, that it may be used as a 'talking point' in selling the Academy to prospects. We, the committee, feel very strongly that there should be some kind of junior academy of science clubs, some suitable publication for juniors in science, or at least some form of affiliation with the Ohio Academy of Science of Junior Academy Clubs. We believe something of this kind would make the Academy important to educators in high schools."

VII. *A New or Revised Constitution and By-Laws* was unanimously approved as indicated above.

VIII. *Resolutions:* See report of the Committee on Resolutions printed elsewhere in these proceedings.

Immediately following the business session on Friday morning occurred the only *General Scientific Meeting* at which three very interesting and highly informing addresses were given, namely: (1) A moving picture film was shown in connection with an address on "Hawaii, a Land of Unique Geology," by Dr. Paris B. Stockdale, of Ohio State University; (2) "Prediction of Floods in the Ohio River," by Professor Edwin L. Moseley, State Normal College; and (3) "A Naturalist's Diary," illustrated in color film, by Mr. Karl Maslowski, of the Cincinnati Museum of Natural History.

Dr. Jarvis called attention to the personnel of the committee and stated the plan of procedure in general would be for the representative of each section on the committee to appoint local representatives in the various colleges and universities over the State, possibly including many of the high schools. He closed with a plea for suggestions and hearty co-operation on the part of all members of the Academy.

On Saturday morning, under the leadership of Dr. Paul B. Sears, of Oberlin College, the University of Cincinnati sponsored a Junior Academy demonstration program entitled "*The Farm Comes to Town.*" It is unfortunate that a larger number of the members of the Academy and others did not hear this decidedly unique presentation of farm conservation problems.

The Annual Dinner on Friday evening, followed by a short business session, was as usual the high spot of the meeting. Dr. J. Hobart Hoskins, chairman of the local committee on arrangements, acted in a most tactful way as toastmaster for

the occasion. He first introduced the President of the University of Cincinnati, Dr. Raymond Walters, who in very gracious and well-chosen words extended a most cordial welcome to the Academy and its guests; then Dr. Robert C. Gowdy welcomed the Academy in the name of the Society of Sigma Xi; then came the Presidential Address on "Taking Inventory," by President Claude E. O'Neal; Dean George F. Arps, Ohio State University, was then introduced as the *Director for the Semi-Centennial* and laid before the Academy his aims, hopes and plans for a great semi-centennial in 1940, and earnestly solicited the full co-operation of every member of the Academy in efforts to make it a worth-while celebration; on behalf of the many local societies in Cincinnati and vicinity Dr. Nevin M. Fenneman spoke words of cordial greeting. To all these words of welcome and good will, President O'Neal responded in appropriate manner.

President O'Neal then assumed the chair and a short business meeting was held at which three items of business as indicated elsewhere were transacted and the meeting adjourned.

Report of the Secretary

CINCINNATI, OHIO, April 14, 1939.

To the Ohio Academy of Science:

This is our fifteenth annual report and will be about the shortest! Office routine does not require nor does it lend itself to interesting or important statement. We have had by far the largest amount of detail to look after the past year than in any of the preceding 15 years because, to be sure, we have really had more work to do, owing to the growth of the Academy and the approaching semi-centennial. Furthermore, the Secretary has been teamed-up with one of the workingest Presidents we have ever had! Properly, one's work should and in fact does speak for itself!

The constitutional duties imposed upon the office of secretary and all requests made upon the office by members and others have been taken care of promptly and, we believe, with reasonable efficiency. Fortunately, we have had ample time for the duties of the office and the fine co-operation of the entire official family has made the work very delightful. We wish here and now to record our most hearty thanks for the generous support received from every officer and member, from the President down.

Among the items over and above the purely routine may be mentioned:

1. Represented the Academy at the Richmond, Va., meeting of the A. A. A. S. and at the Academy Conference;

2. Revision and printing of the leaflet entitled "The Ohio Academy of Science," assisted by the Treasurer;

3. Revision and printing of several forms, such as the Notice of election to office, committee and membership; to Fellowship, etc.

4. Assisted in the campaign for new members—"One Thousand Members by 1940!"

5. We have fostered and encouraged as far as possible the junior academy idea and we wish to put on record here and now our firm opinion that the Ohio Academy of Science is face to face with the junior academy problem which will not "down" until properly solved. If we do not actually assist in the formation of the junior clubs we must provide some form of *affiliation.*

6. In a limited way we have encouraged legislation favorable to conservation of our natural resources, the establishment of public parks, etc.

In short, we have tried to be useful in as many ways as possible.

Respectfully submitted,

WILLIAM H. ALEXANDER,
Secretary.

Report of the Treasurer

To the Ohio Academy of Science:

Statement of Income and Expenses for the year ended December 31, 1938.

Cash on hand January 1, 1938		$ 191.96
CASH RECEIPTS:		
Membership Dues—		
1935	$ 5.00	
1936	30.00	
1937	145.00	
1938	1,081.18	
1939	17.50	
Total received from membership dues	$1,278.68	
Grants for Research from A. A. A. S.	150.00	
Interest on Bonds	39.00	
Sale of Publications	56.86	
Dinner Receipts	17.75	
Miscellaneous Receipts	.52	
Total Cash Receipts for the Year		1,542.81
Total Cash to be Accounted for		$1,734.77
CASH DISBURSEMENTS:		
Speakers	$ 25.00	
Clerical Assistance	20.40	
Postage and Telegraph	58.00	
Office Supplies	39.04	
Expense of Officers to Meetings	84.69	

Printing:		
Proceedings in Ohio Journal of Science, 1937	$191.59	
Proceedings in Ohio Journal of Science, 1938	132.26	
Other Printing Expense	70.75	
Total Printing Expense		394.60
Subscriptions:		
Ohio Journal of Science, 1937	$ 97.50	
Ohio Journal of Science, 1938	555.00	
Total Subscriptions		652.50
Research Grants		250.00
Secretary's Honorarium		100.00
Safety Deposit Box Rent		3.30
Reporting 1938 Meeting		8.60
Bond for Treasurer		5.00
Auditing Expense		15.00
Bank Charges		3.18
Total Cash Disbursements for the Year		1,659.31
Cash on hand December 31, 1938		$ 75.46
		$1,734.77

Respectfully submitted,

EUGENE VAN CLEEF,
Treasurer.

Report of the Auditor

COLUMBUS, OHIO, February 23, 1939.

To the Ohio Academy of Science:

Pursuant to your instructions, I have audited the accounts and records of the Treasurer of the Ohio Academy of Science for the year ended December 31, 1938. These records and accounts were found to be accurately and honestly kept, and to be adequate for the purpose of controlling the financial operations, and furnishing the necessary information concerning the financial transactions of the association.

All cash receipts and disbursements for the period under review were carefully checked. The cash in bank current fund was verified by confirmation by the bank and reconcilement with the book balance. Cash in the special research fund was not verified by bank confirmation.

Members accounts receivable were certified to your auditor by the treasurer of your association.

Investment securities in the current fund were examined and found to be as stated in the records. Securities of the special research fund were not verified by examination.

I hereby certify that in my opinion the accompanying Balance Sheet sets forth fairly the financial condition of the Ohio Academy of Science as at December 31, 1938, and that the Statement of Operating Results correctly summarizes the transactions for the fiscal year ended December 31, 1938, and the changes in net worth resulting therefrom.

Very truly yours,

D. M. SHONTING,
Public Accountant.

Report of the Trustees of the Research Fund

To the Ohio Academy of Science:

The Trustees beg of you to report for the year 1938 the following statement of financial condition:

SUMMARY OF RECEIPTS

Balance in Checking Account December 31, 1937	$ 247.27
Received	73.00
Total	$ 320.27

DISBURSEMENTS

Service Charge at Bank	$ .75
Balance Checking Account December 31, 1938	$ 319.52

ASSETS, DECEMBER 31, 1938

Bonds (at cost)	$1,300.00
Banc Ohio Stock (at cost)	437.50
Balance Checking Account, Ohio National Bank	319.52
Total	$2,057.02

No grant from this fund was made during the year, but the allowance from the A. A. A. S. of $150.00 was assigned: $100.00 to Geo. D. Hubbard, Oberlin, Ohio, for investigations on Preglacial Lake Beds in Ohio, and $50.00 to Frank Verhoek, O. S. U., for special apparatus in research work.

Also we may state that since January 1, 1939, a grant from the A. A. A. S. of $150.00 has been alloted to Dr. E. Lucy Braun for investigations on the major associations of the deciduous forest formation of eastern United States, and from the Academy Research fund the trustees have approved a grant of $100.00 to Dr. G. D. Hubbard for a continuation of his studies on preglacial lake beds in Ohio. We have also other applications pending and will probably allot a considerable portion of the available balance. However, further applications will be welcome.

There is no doubt that many worthy projects could be encouraged by modest grants and it is hoped that additional research funds may become available. We would urge an effort to secure such additions by additional life memberships or donations.

In connection with the 50th anniversary in the coming year it would seem appropriate to give a historical sketch of the McMillin fund with indication of the amounts alloted for the various research projects which were assisted by grants from this fund and the subsequent additions to the Academy Research funds. The data for such a sketch is largely in hand and it would seem possible to make a fairly distinctive report that would be of interest to the Academy.

A preliminary review of the records shows that grants of near $6,000.00 have been made to some 50 individuals to assist over sixty different projects.

Respectfully submitted,

HERBERT OSBORN, *Chairman,*
WM. LLOYD EVANS,
JAMES P. PORTER,
Trustees.

Report of the Executive Committee

By the Secretary

CINCINNATI, OHIO, April 14, 1939.

To the Ohio Academy of Science:

Your Executive Committee has held five meetings during the year with all members present at three of the meetings, all but one present at one meeting and two absent at one meeting—probably a record for committee meetings! Certainly an indication of the aggressive, energetic administration put on by our active, ambitious President!

The major items of business above mere routine in importance transacted at these meetings may be mentioned the following:

1. The approval of 57 applications for membership, all of which have been passed on to the Membership Committee for inspection and recommendation.

2. The Treasurer was authorized to drop all members of the Academy who are more than two years in arrears with their dues, after final notice.

3. The appointment of a Director, Dean George F. Arps, as Director of the semi-centennial and the appointment of the ten committees provided for in the preliminary plans of the celebration.

4. The selection of the place and the fixing of the date of the annual meeting for 1939.

5. Considered in detail the preliminary report of the Committee on the Revision of the Constitution and By-Laws.

6. Considered a preliminary report by the committee appointed to co-operate with the State Director of Education relative to the proper training of teachers of science in the junior and senior high schools of the State.

7. The Treasurer was authorized and requested to confer with Joint Administrative Board and see what, if anything, could be done toward a readjustment of the financial arrangements now existing between the Academy and the Board, and failing this to confer with the Ohio State University authorities in the hope of securing an increased allowance from that institution.

8. The tentative date of May 9, 10 and 11, 1940, was fixed for the Semi-Centennial.

9. Approval was given to an intensive membership campaign and the slogan suggested by the Secretary, "One Thousand Members by 1940," was adopted.

10. Unanimously approved the recommendations of the Committee on Conservation.

Report of Membership Committee

CINCINNATI, OHIO, April 14, 1939.

To the Ohio Academy of Science:

The following applications for membership in the Academy, accompanied by one year's dues, have been received during the year, approved by the Executive or Membership Committee, or both, and are now recommended for final approval by the Academy, viz.:

AVERY, WILLIS F. (F), The B. F. Goodrich Co., Akron.
BERGER, BENJAMIN, (D), 133 W. Ninth Ave., Columbus.
BILLS, ARTHUR G., (E), 3423 Whitfield Ave., Cincinnati.
BRAND, LOUIS, (I), 2603 University Court, Cincinnati.
BRIEF, B. J., (D), 769 Kimball Place, Columbus.
BUNCH, ROSELLA, (C), 186 W. College St., Oberlin.
BURGESS, WAYLAND M., (H), University of Cincinnati, Cincinnati.
CHANDLER, DAVID C., (A), Stone Laboratory, Put-in-Bay.
CHILDRESS, NORMAN F. (B and H), Ohio State University, Columbus.
CLARK, PAUL ENOCH, (H, I and F), New Concord.
COGHILL, G. E., (A), R. F. D. No. 2, Box 77A, Gainesville, Fla.
COLE, LAWRENCE E., (E), 111 S. Cedar, Oberlin.
COLES, VICTOR, (A and B), 2910 Grasselli Ave., Cincinnati.
CONSOLATA, SISTER MARY, (H), 2234 Overlook Road, Cleveland.
COTTERMAN, CHAS. W., (A), B. & Z. Bldg., O. S. U., Columbus.
CUNNINGHAM, JOHN F., (A and B), Townshend Hall, O. S. U., Columbus.
DAMBACH, CHARLES A., (A and B), 1902 Auburn Ave., Dayton.
DEAROFF, KENNETH, (B), Public Library Museum, Dayton.
DOAN, KENNETH H., (A), Stone Laboratory, Put-in-Bay.
DUNLAP, H. L., (H), 275 E. State St., Athens.
FIDDLER, MRS. CLARICE MCADOW, (A and B), Hotel Hester, Manchester.
FIELDS, PAUL E., (E), 138 N. Sandusky St., Delaware.
FRONIUS, ARTHUR GEORGE, (H, F and E), 785 New Garden Ave., Salem.
GARRETT, ALFRED B., (H), 205 W. Henderson Rd., Columbus.
GIBBONS, CHARLES C., (E), 115 Sixteenth Ave., Columbus.
GIER, HERSCHEL T., (A), Ohio University, Athens.
GOLDBERG, LAWRENCE, (D), 38 W. Washington, Athens.
HANSEN, HUGH GROVES, (G), 76 E. College St., Oberlin.
HODGMAN, CHARLES D., (F), Case School of Applied Science, Cleveland.
HODGMAN, MARGARET E., (B), 2119 Marlindale Rd., Cleveland Heights.
HOUSEHOLDER, FRED F., (F), 1209 Berwin St., Akron.
HUGHES, JOHN H., (A), 81 South St., Jackson.
IRELAND, HUBERT ANDREW, (C), Soil Conservation Service, 447 N. Broadway, New Philadelphia.
KELLY, HENRY A., (C, A, H and F), 316 W. Washington St., Howell, Mich.
KNAUSS, HAROLD P., (F), Mendenhall Laboratory, O. S. U., Columbus.
LANDE, ALFRED, (F), Mendenhall Laboratory, O. S. U., Columbus.
LEWIS, ROBERT DONALD, (B), Department of Agronomy, O. S. U., Columbus.
MARTIN, GEORGE C., JR., (C), 46 W. Tenth Ave., Columbus.
MOLZ, FRANCIS J., (A and B), University of Dayton, Dayton.
MOULTHROP, PHILIP N., (A), 2717 Euclid Ave., Cleveland.
NELSON, R. H., (A), 151 W. Eleventh Ave., Columbus.
NOVY, WILLIAM S., (A), 41½ W. Washington, Athens.
OSGOOD, THOMAS H., (F), University of Toledo, Toledo.
POPHAM, RICHARD A., (B), Botany Department, O. S. U., Columbus.
POOL, M. L., (F), Ohio State University, Columbus.
PORTER, LAWRENCE HAROLD, (B), B. & Z. Bldg., O. S. U., Columbus.
PORTER, T. WAYNE, (A), 327 W. Water St., Oak Harbor.
PRATHER, W. D., (H and A), 408 Broadway, Aurora, Ind.
PYLE, W. R., (F), 240 Fife St., Wilmington.
QUIRING, DANIEL P., (A and B), Western Reserve University, Cleveland.

Reynolds, Ralph J., (B and A), 2645 Powell Ave., Columbus.
Rich, John L., (C), University of Cincinnati, Cincinnati.
Ring, Gordon C., (D), Hamilton Hall, O. S. U., Columbus.
Rockwood, Ruth C., (G), R. F. D. No. 1, La Grange.
Shankland, Robert S., (F), Case School of Applied Science, Cleveland.
Sharpe, C. F. Stewart, (C and G), 337 Ashwood Lane, N. W., New Philadelphia.
Siekeres, Albert, (A and F), Kipton, Ohio.
Smith, Ruth Elizabeth, (C), 109 Lakeside, New Concord.
Snoddy, A. O., (H), R. F. D. No. 6, Cincinnati.
Sperti, George Speri, (Scientific Research and Education), 6616 Beechmont Ave., Cincinnati.
Stoltz, Robert B., (Dairy Mfg.), 1971 Concord Rd., Columbus.
Stumm, Erwin O., (C), Oberlin.
Sumner, Charles B., (A, B and D), Kent State University, Kent.
Thornton, C. S., (A and B), Kenyon College, Gambier.
Unnewehr, E. C., (F), 109 Seminary St., Berea.
Vaughn, James, (E), 413 McAlpin, Cincinnati.
Von Dach, Herman, (A), B. & Z. Bldg., O. S. U., Columbus.
Williamson, C. O., (I), College of Wooster, Wooster.

Respectfully submitted,

C. W. Jarvis,
Chairman.

Report of the Joint Administrative Board of the Ohio Journal of Science

Cincinnati, Ohio, April 14, 1939.

To the Ohio Academy of Science:

The only meeting of the Joint Administrative Board of the Ohio Journal of Science since the last report was held at the Ohio State University, April 1, 1939. Present were all members of the board, the editor and the business manager. The meeting was called to order by Chairman Rice at about 1:00 P. M. The minutes of the preceding meeting were read and approved.

Upon motion, the terms of all present officers were continued for the year 1939.

Motion carried that the Journal carry an article dealing with the services of the late Prof. J. H. Schaffner as past editor of the Journal. Motion carried that the Joint Administrative Board recommend to the Ohio Academy of Science that the proceedings of the 50th anniversary meeting of the Ohio Academy of Science, whatever its format, be issued as part of the regular publication series of the Ohio Journal of Science. It was agreed that the recommendation would not be formally presented to the Academy without the prior approval of Dean Arps. Dr. Transeau agreed to discuss this matter with Dean Arps.

The business manager of the Journal tendered his formal resignation of this position, to be effective at the end of the present fiscal year.

The business manager presented his financial report for the fiscal year 1938 as follows:

RECEIPTS

Balance from 1937	$ 437.20
From Ohio State University	750.00
Ohio Academy of Science—Dues	640.50
Ohio Academy of Science—Publication of Proceedings	132.26
Subscriptions	74.94
Author's Payments for Plates	92.46
Sale of Back Numbers	38.50
	$2,165.86

EXPENDITURES

Spahr and Glenn Co., Printing Vol. 37, No. 6	$ 497.17
Spahr and Glenn Co., Printing Vol. 38	1,331.71
Postmaster, Columbus, Ohio	108.00
Bucher Engraving Co	201.14
Clerical Assistance	6.50
	$2,144.52
Balance on Hand, January 27, 1939 (Huntington National Bank)	21.34
	$2,165.86

As of this date one bill to the Bucher Engraving Co., in the amount of $39.56, was unpaid. All other 1938 bills are paid.

Upon motion this report was accepted and placed on file, Dr. Transeau being appointed a committee of one to audit the business manager's report.

The meeting adjourned at about 2:00 P. M.

Respectfully submitted,

B. S. MEYER,
Secretary of the Board.

Report of the Library Committee

COLUMBUS, OHIO, April 11, 1939.

To the Ohio Academy of Science:

Much of the routine work of the chairman of this committee has consisted in taking care of the mailing list and in supplying numbers of the Ohio Journal of Science when requested.

Late in the year the exchanges were checked in the Ohio State University Library and only a few were found to be inactive. Some of them sent their publications in response to letters which were written to them and the others were dropped from the mailing list. Five new exchanges were added, making a total of 361, of which 97 are in this country and 264 in foreign countries. As some of them send more than one publication we are now receiving nearly 560 different titles. A few publications also come as gifts. A complete list of the exchanges was typed onto sheets and distributed to the members of the library committee and to several others.

The sales of publications amounted to $25.15. The largest single order was for fourteen copies of Dr. W. G. Stover's Agaricaceae of Ohio and was placed by the Botany Department of Ohio University.

Thirty-seven copies of ten Special Papers were sold in eighteen sales. Only two sales were made to persons living outside of our own State. The sum of $57.38 has been given to the Treasurer. This included $32.25 which was withdrawn from the building and loan company when the account of the Academy was closed at the beginning of the year. This fact was mentioned in last year's report, but it is stated again this year as it appears in the financial report which is appended to this report but not included in it. A copy is on file for the purpose of record in the office of the Treasurer and also in the library of the chairman of this committee.

Respectfully submitted,

ETHEL MELSHEIMER MILLER,
Chairman.

Report of Committee to Co-operate with Ohio Department of Education

CINCINNATI, OHIO, April 14, 1939.

To the Ohio Academy of Science:

The Committee appointed by the President pursuant to a resolution passed by the Ohio Academy of Science at the annual meeting one year ago to co-operate with the Ohio Department of Education in outlining the proper requirements in preparing teachers of science for the Ohio junior and senior high schools, submits the following and recommends its approval by the Academy, viz.:

1. All applicants for certification as teachers of science in the junior and senior high schools under the laws of Ohio shall be required to present as a *minimum preparation* 40 semester hours in science, consisting of 24 semester hours distributed as follows: 6 semester hours in Botany, 6 semester hours in Zoology, 6 semester hours in Chemistry, 6 semester hours in Physics, or their equivalent as defined by the several institutions of higher education in Ohio, and 16 further hours elected from the above subjects, or from Astronomy and Geology.

2. (a) A student seeking the Master's degree in order to qualify under the proposed Ohio requirements may complete these degree requirements in the field of science rather than in a specific department;
   (b) Or in Physical Science and Biological Science.
   (c) Or a major in Physical Science and a minor in Biological Science, or vice versa;
   (d) Or a major in a department.

Respectfully,

C. G. SHATZER, *Chairman,*
W. A. MANUEL,
H. C. SAMPSON,
A. W. LINDSEY.

Recommendation unanimously approved by the Academy, April 14, 1939.—W. H. ALEXANDER, *Secretary.*

Report of the Committee on Conservation

CINCINNATI, OHIO, April 13, 1939.

To the Ohio Academy of Science:

Your Committee on Conservation begs to submit the following report of conservation activities in Ohio during the past year.

Division of Conservation—An important milestone in the annals of Ohio conservation was passed, it is believed, when the Ohio legislature enacted Senate Bill No. 165, which is designed to remove conservation matters from politics. Briefly, the bill provides that the Commissioner of Conservation and not more than two Assistant Commissioners be appointed by the Conservation Commission, instead of by the Director of Agriculture, as heretofore; and the terms of the members of the Commission are increased to eight years, in order to lessen the likelihood of any given political administration gaining control over the Commission. The name of the division is made to include natural resources: the Division of Conservation and Natural Resources. The Commission controls matters of policy and program and the Commissioner has charge of personnel.

A brief review of the history of official conservation activity has been provided by Mr. E. L. Wickliff:

In 1873 the Ohio legislature passed a bill providing for the appointment of three Fish Commissioners. The commissioners were appointed in 1875, marking the beginning of our present Division of Conservation and Natural Resources. It will be noted that the Fish Commission devoted all its activities to fish and that game was not at this early stage of development deemed to require attention. Among other duties of the Fish Commission were: "To examine the various rivers, lakes, ponds and streams of the state of Ohio—with a view of ascertaining where they can be rendered more productive of fish and what measures are desirable to effect this object, either in restoring the production of fish in them or in protecting or propagating the fish that at present frequent them . . ." It will thus be seen that the duties of the Fish Commissioners were much the same as they are today and that even in those days they talked about depletion and the restoration of the depleted fish supply, just as we do today.

In 1886 the legislature provided for a Fish and Game Commission of five members, adding the protection of game to their duties. In 1913, the Division of Fish and Game was placed under the State Department of Agriculture. In 1923, an Advisory Board was appointed. In 1929 the legislature changed the name of the Division of Fish and Game to the Division of Conservation.

Soil Conservation—In Ohio at the present time there are 5 Erosion Control Demonstration projects and 11 CCC camp work areas. The project areas which cover rather intensively all or a part of the drainage basin or watershed of a stream are located near Wooster, Mt. Vernon, Zanesville, Hamilton, and Cambridge. The work areas of these five projects touch 10 counties.

Each CCC camp work area usually includes a number of farms in one county, and usually extends to one tier of townships in the adjoining counties. The present camps are located near Bellefontaine, Eaton, Lebanon, Wilmington, Peebles, Chillicothe, Lancaster, Mt. Vernon, Carrollton, Shreve and Zanesville.

The number of farms for which complete conservation plans have been developed total approximately 2,700. This is about 1 percent of the farms of the state and 1½ percent of the land in farms. These demonstrations are distributed in about 60 of the 88 counties. The following table shows the change in land use on 331,311 operating under a co-operative agreement with the Soil Conservation Service.

	Before Planning %	After Planning %
Crop Land	54.5	43.2
Permanent Pasture	29.0	30.0
Permanent Hay	0.9	5.4
Woodland	4.1	15.4
Miscellaneous	11.5	6.0

On these farms on 147,446 acres of crop land the percentage distribution of erosion control practices is as follows:

Contour Tilled	52.2 percent
Strip Cropped	26.1 "
Terraced	2.2 "
Combination of Terracing and Strip Cropping	0.5 "

It is very evident that contour tillage and strip cropping are the most common erosion control practices in Ohio.

Sealing of Abandoned Mines—Report from Mr. F. H. Waring, Chief of the Division of Engineering of the Ohio Department of Health for 1938, covers the accomplishment for that year and for the last five years. Abandoned mines have been sealed in 25 counties along the Ohio River from Mahoning on the north to Scioto on the south and as far inland as Coshocton County. Funds for this work have been provided by the Federal Government through CWA, ERA, and WPA.

As of December 31, 1938, a total expenditure of $1,929,337.02 of federal funds had been made for this work, and the following accomplished in the five-year period: Openings closed, 57,426; water samples collected, 12,446; labor costs, $1,769,798.11; material costs, $53,218.05; supervisory cost, $106,320.86; cost per opening closed, $33.60; counties worked, 25; mines sealed, 3,468; per cent acid reduction 64.7 (based on a study of 1,301 mines to July 1, 1938); average acid per mine in tons per year, 58.7 (based on a study of 1,671 mines to July 1, 1938); average cost per mine, $518; average number of openings per mine, 14.6; and cost per ton acid, $8.86. Of the total cost, 91.8 per cent was expended for labor, 2.7 for materials, and 5.5 for supervision.

During the year 1938, a federal expenditure of $904,782.76 was made in sealing 29,895 mine openings in 2,043 mines in 25 counties, with a labor cost of 94.8 per cent, materials 2.9 per cent, and supervision 2.3 per cent. The average cost of sealing openings was $30.27.

The original acid contained in the drainage from 1,301 mines studied was 74,495.47 tons per year; at the last sampling, in the second quarter of 1938, it had been reduced to 26,288.42 tons per year. The average cost of sealing each of these mines was $469.84. On July 1, 1938, records on 1,671 sealed mines showed they contained 24,446 openings (an average of 14.6 each), the original acid content of the drainage was 98,010.90 tons per year, and the average acidity was 58.7 tons per year.

Employment during 1938 varied from 1,849 men in May to 995 in December. All abandoned mines were sealed in 15 counties where permission could be obtained from the surface owners and the mining-rights owners to do so. This included by far the greater part of the abandoned mines in these counties. Active work is still being carried on in 10 counties.

On July 1, 1938, the supervisory staff of 14 persons employed by the U. S. Public Health Service and paid with WPA funds was discontinued and since that date only one part-time engineer from the State Health Department has given supervision to the project.

A new project was submitted to the Federal Government for approval in the latter part of 1938 for a total expenditure of $484,160, of which $448,592 represented federal funds. This project was to cover 15,150 mine openings, with the greater part of the work to be done in counties in which work has not been completed.

However, it is contemplated that considerable maintenance work will be necessary in the other counties in order to repair the seals of openings already closed, and to close any openings which have developed since the sealing was done.

The Department of Health provided exhibits of this work at Cincinnati Sportsmen's Show and the Toledo Sportsmen's Show. Likewise, considerable publicity has been given to the benefits of mine sealing projects through use of the public press. The work is in charge of Engineer B. F. Hatch, of the Department.

Department of Forestry—For financial reasons the program of the Division of Forestry during the past year has not been greatly expanded.

However, it was possible to place a man on public relations work. Although the appointment was not made until October, the effects of this work are already being appreciated.

Recreational use of the state forests and forest parks continues to increase. This reflects an increased drain on maintenance funds which have not been adequate to meet the situation. During the year just ahead the Division will be expected to employ any help necessary to plan CCC projects and maintain all completed work. Failure to meet this obligation will lead to the loss of some, if not all, of the camps now operating on the state forests.

The area of forests receiving organized forest fire protection remains at 1,000,000 acres with another million acres in need of protection which cannot now be provided.

Three land utilization projects totaling more than 35,000 acres will be turned over to the Division early in 1939. On each project

are extensive recreational developments, the successful operation of which will require additional personnel.

The Division of Forestry has assumed sponsorship for a WPA project having as its threefold objective the survey of farm woods in 21 counties in Ohio, a survey of the forest plantations in the State and the eradication of *Ribes* in those sections of Ohio where white pine is, or may be, of economic importance. This project which is under the direct supervision of trained foresters is expected to yield a great deal of very valuable information.

Ohio Wildlife Research Station—Of the 19 projects of the Ohio Wildlife Research Station, two are new and five were completed during the last year. The number of persons engaged in whole or part time work related to wildlife research of the Station during 1938–39, was 24. Twelve reports have been published, 26 mimeographs issued, and 42 manuscript progress reports filed. Present projects involve areas in 72 of the 88 counties of the State.

Pheasant refuge and controlled hunting management techniques developed in Wood County are rapidly being put into operation elsewhere in Ohio and, to a lesser extent, in several other States. A series of reports based on the Wood County studies are now available, which involve critical explorations in the fields of wildlife-agricultural land-use, game economics, game yields in relation to management and land-use, controlled hunting and farmer-sportsmen relationships. As a result of these reports, the exact factors involved in producing sustained annual pheasant crops are probably better known for Wood County than for any other in the United States.

Studies have continued in the development of techniques for conditioning breeding stock of pheasants, raccoon, rabbits and other species to increase their "stocking value." A recent report summarized the record of more than 10,000 surplus naturally produced wild pheasants which were live-trapped on three Wood County refuges. Banding returns and population studies indicate that birds so obtained have a stocking value far superior to that of birds produced on game farms. This research points the way to a day not far distant when game farms with their artificial propagation will be abolished, releasing man-power and money for practical development of natural habitats in accordance with sound ecological land-use principles. The development of techniques for producing in the wild surpluses of superior native brood stocks, will eliminate, for example, the inexcusable importation of western rabbits and the tularemia and Rocky Mountain fever which comes along with them.

A monographic study of the Fox Squirrel nears completion. This includes many critical ecological land-use studies of Ohio woodlots and population data on more than a thousand animals trapped and tagged. Similar studies have been made of 900 live-trapped rabbits. A survey of Ohio squirrel diseases has been completed and is now being prepared for publication. Two other long-time projects concern (a) a statistical and ecological analysis of the raccoon populations of two central Ohio counties, and (b) disease, nutrition, reproduction and conditioning studies of 2,200 captive raccoon at the Milan farms.

A ten-year survey of population fluctuations of the Hungarian Partridge is nearing completion. At Pymatuning Lake more than 1,000 waterfowl have been banded to study the origin and dispersal of a newly created waterfowl population located on the divide between the great Atlantic and Mississippi flyways.

The conservation education program of the Ohio Wildlife Research Station grows each year. During the last twelve months the staff has given 42 lectures and radio talks, held conferences with 251 visitors (many from outside Ohio) on problems of the wildlife profession, given advanced undergraduate or graduate training and instruction to 18 students, given technical assistance on 148 wildlife conservation problems in Ohio, arranged five extensive wildlife management exhibits, participated in youth education, 4-H Club and camp work, and distributed more than 210,000 pages of reports on Ohio conservation research.

Southern Ohio Wildlife Sanctuary and Demonstration Project—The wildlife sanctuary and research project sponsored and encouraged by the Ohio Academy of Science in Southern Ohio now enters its fifth year. During the first four years, fourteen sanctuaries and refuges were established on the Roosevelt Game Preserve, and the Shawnee, Scioto Trail, and Pike County State Forests. Major research studies involving wildlife land-use; forestry-wildlife relationships; wildlife harvest methods; life history, ecology, and management of the White-tailed Deer, Ruffed Grouse, and Gray Squirrel; and surveys of the wildlife food, cover, and water resources were brought to a close in September, 1938, when the investigator, Floyd B. Chapman, was awarded a Doctor's degree in Wildlife Conservation at the Ohio State University. The subject of the dissertation was "The Development and Utilization of the Wildlife Resources of Unglaciated Ohio." Bound copies of this 800 page report are on file in the Ohio State University Library, the Ohio Division of Conservation, the U. S. Biological Survey, and the Ohio Wildlife Research Unit. Two sections of the dissertation have been published by the American Wildlife Institute, namely: "Summary of the Ohio Gray Squirrel Investigation" and "The White-tailed Deer and its Management in Southeastern Ohio."

In 1939 it is planned to enlarge the sanctuary program to include other State Forest areas and the Wayne National Forest. At present three sanctuaries are being placed in the Ross-Hocking State Forest, and it is planned to establish three areas in the Zaleski State Forest, Vinton County, in the near future. One or more refuges will be set aside in the Vesuvius section of the Wayne Forest in Lawrence County, and in Muskingum County, three refuges are being established in the Muskingum Resettlement project. Dr. Chapman has been placed in charge of all wildlife management work on public lands in Southern Ohio, with headquarters at Chillicothe. The major objective during the next few years will be to put into effect the wildlife management and other recommendations incorporated in the preliminary research report.

RECOMMENDATIONS

(1) Inasmuch as the Geological Survey of Ohio is of fundamental importance respecting our knowledge not only of the mineral resources of Ohio, but also of our biological resources, that adequate appropriation of funds be allowed for the continuance of the work.

(2) Your committee recognizes the fundamental importance of the soil survey in the program of land-use planning and soil conservation and urges that adequate funds be provided for the completion of these surveys.

(3) Your committee recommends that the Division of Conservation and Natural Resources and the State Department of Education co-operate in a program for the teaching of the principles of Conservation in the public schools of the state.

(4) Your Committee recommends that the Academy request the Legislature now in session to adopt such legislation as will effectively create a co-ordinating board made up of directors of the various State departments interested in conservation, forestry and recreational activities for the State: Such board also to make a complete survey of the natural resources of the State for the purpose of formulating a policy and program for administering the use of our natural resources.

(5) Recognizing the benefits to our streams from the sealing of abandoned coal mines in the reduced amount of acid draining into them, your committee urges that an adequate annual appropriation be made for the maintenance of openings already closed and the sealing of recently abandoned mines.

(6) Your committee recommends an investigation as to the relation between the importation of western rabbits and the apparent increase of tularemia and Rocky Mountain spotted fever in Ohio.

(7) Your committee urges the acquisition by the state for purposes of conservation and recreation of natural areas threatened with destruction, and specifically recommends the following: (1) A series of state parks on Lake Erie, (2) The Oak Openings west of Toledo, (3) Fern Lake in Geauga County, (4) Additional areas at Fort Hill, Highland County, (5) The Beaver Creek region in Columbiana County, (6) Rock Run in Jackson County, and (7) Cedar Swamp in Champaign County.

(8) Convinced of the soundness of the recommendations of this committee in former years, your committee reaffirms and urges the adoption of the same.

Respectfully submitted,

EMERY R. HAYHURST, EDWARD S. THOMAS, *Chairman*,
EDMUND SECREST, W. E. STOUT,
L. E. HICKS, G. W. CONREY,
F. H. KRECKER, E. L. WICKLIFF,
ROBERT B. GORDON.

Report of Committee on Election of Fellows

CINCINNATI, OHIO, April 14, 1939.

To the Ohio Academy of Science:

The Committee on the Election of Fellows met last evening at Hotel Gibson, Cincinnati, Ohio, with all members present except two, the President of the Academy presiding. All nominations to fellowship then on file were carefully considered by the committee and the following members received the required three-fourths vote of the committee and were therefore declared elected to Fellowship in the Ohio Academy of Science, viz.:

DR. AMOS C. ANDERSON.....Ohio University
DR. ROLLO CLYDE BAKER.....Ohio State University
DR. CECIL ERNEST BOORD.....Ohio State University
DR. LOUIS BRAND.....University of Cincinnati
DR. JOHN BERNIS BROWN.....Ohio State University
DR. GEORGE M. CURTIS.....Ohio State University
DR. CHARLES AUSTIN DOAN.....Ohio State University
DR. BRUCE C. FREEMAN.....Ohio State University
DR. NOEL PAUL HUDSON.....Ohio State University
DR. HAROLD JOHN KERSTEN.....University of Cincinnati
DR. PAUL CLIFFORD KITCHIN.....Ohio State University
DR. CARL A. LAMEY.....Ohio State University
DR. LAWRENCE L. QUILL.....Ohio State University
DR. FRANCIS E. RAY.....University of Cincinnati
DR. JOHN LYON RICH.....University of Cincinnati
DR. PAUL BIGELOW SEARS.....Oberlin College
DR. LEON E. SMITH.....Denison University
DR. JOHN AUGUSTUS TOOMEY.....Western Reserve University

Respectfully submitted,

WILLIAM H. ALEXANDER,
Secretary.

Report of Committee on Necrology

CINCINNATI, OHIO, April 15, 1939.

To the Ohio Academy of Science:

Notice of the death of but two members of the Academy during the year has come to the attention of your committee, both very distinguished in their chosen fields and highly honored not only among the members of this Academy but by scientists generally, namely, Dr. John H. Schaffner and Dr. Samuel Prentiss Baldwin. A brief outline of the life and work of each follows:

SAMUEL PRENTISS BALDWIN

FRANCIS H. HERRICK

Samuel Prentiss Baldwin, widely known for his pioneer work in trapping and banding wild birds and for his Research Bird Laboratory, was born at Cleveland, Ohio, on October 26, 1868, and died of coronary

thrombosis in that city on December 31, 1938. He was the son of Charles Candee and Sophia (Prentiss) Baldwin.

His father, a judge of the circuit court of appeals, was one of the founders and principal supporters of the Western Reserve Historical Society and was deeply interested in archaeology and geology. The son was a trustee of the Historical Society from 1907 until the end of his life.

Graduating from Dartmouth College in 1892, and from the Law School of Western Reserve University in 1894, Prentiss Baldwin withdrew from the practice of law in Cleveland in 1900, and for a number of years was engaged in business. After some field work in geology, he returned to his first love, natural history, and devoted himself more or less completely to ornithology.

In 1914 Mr. Baldwin became interested in the newly devised method of banding wild birds—encircling one of their legs with a numbered, aluminum ring or band—so that, if later recovered and reported, incontrovertible data upon their wanderings and longevity could be secured. In the course of these practices, which were systematically conducted in summer at "Hillcrest Farm," the Gates Mills property of Mr. and Mrs. Baldwin, in Ohio, and at Thomasville, Ga., in winter, he devised traps for securing large numbers of living birds, and originated the method of trapping-and-banding adult birds, which by 1920 had become so successful that it was approved by the Biological Survey. This governmental agency, which took over the work of the American Bird-Banding Society in 1920, soon became the "clearing house" for the registration of the recovered and reported aluminum bands that began to flow in from all parts of the country. As a result of this movement four Bird-Banding Associations, the Inland, Eastern, Northeastern and Western, were established. It is estimated that Dr. Baldwin, who became the honorary president of all of these organizations, and his assistants alone have banded between 50,000 and 60,000 individuals.

Since 1914 Prentiss Baldwin was devoted to the intensive study of ornithology at what became known as "The Baldwin Bird Research Laboratory" at the "Hillcrest Farm," from which have issued upwards of thirty more or less elaborate papers or treatises, relating to the physiology, development and life-history of birds, based upon his own work and that of his associates.

Dr. Baldwin soon fixed upon the little house wren as the one species that was best suited for the study of many avian problems, touching distribution, migration, anatomy, physiology, development and behavior. In short this wren, through studies at the Baldwin Laboratory, became in some measure for ornithology what the diminutive fruit-fly, *Drosophila*, is for the science of heredity or genetics. The wren, like *Drosophila*, is easily handled and controlled; it nests readily in artificial boxes, wherever placed, and can be trapped in its nest-box and quickly caught in a hand-net for examination. If it does not submit complacently to interference, it seldom or never deserts its young.

Through the testimony of the numbered bands it was shown that house wrens do not mate for life, but that on the contrary they often

change mates between seasons, and even between broods of the same year. It was also proved that not more than one-third of all marked individuals return to their nests, or to the locality in which their young were hatched, in two successive years.

Many ingenious electrical recording devices, originating in the Baldwin Laboratory, were used in determining the bodily temperature changes, which the growing young undergo from an early egg-stage to adolescence, and in recording visits of the parent birds to their nest when tending their young. Experimenters in this laboratory also perfected an instrument for taking motion pictures of the developing living embryo *in ovo*.

Dr. Baldwin was a trustee of the Cleveland Museum of Natural History for nearly sixteen years, or from 1923 until his death, and in many ways gave it his generous support. He received the degree of D.Sc. from Dartmouth College in 1932, was a fellow in the American Association for the Advancement of Science, the Geological Society of America, the American Ornithologists' Union and the Ohio Academy of Science, and a member of the American Society of Naturalists, the American Society of Zoologists, the British Ornithologists' Union, Deutsche Ornithologische Gesellschaft and the Australasian Ornithological Union.

Through his efforts and those of his assistants, Dr. Baldwin had gathered a remarkably rich store of scientific data upon birdlife, represented chiefly by the house wren, which, if properly edited should make an outstanding monograph. It is to be hoped that this work, for which he had labored so industriously, but which unfortunately he did not live to complete himself, may yet be given to the world.

Dr. Baldwin was married on February 15, 1898, to Miss Lilian Converse, daughter of Leonard Hanna, of Cleveland.

In his personal relations Prentiss Baldwin will be remembered as a loyal friend, who was ever ready to extend a helping hand, especially to young men who were devoted to science. He took a broad view of his opportunities, and freely gave his time, his effort and his means for the protection and preservation of the wild life of the countryside. The many friends of Dr. and Mrs. Baldwin, and particularly the members of Western Reserve University, of which he was a research associate in biology, can never forget the generous hospitality which they have enjoyed in their beautiful home.

Professor Schaffner

Adolph Waller

With the passing of Professor Schaffner, there is defined for botanical sciences another landmark of a period now gone. We are tempted to think of these devoted members as giants because of the work accomplished extending into many fields. No young man today in an era of restricted research would possess the temerity to grasp, or the courage to look forward to solving new problems in so many divergent lines as seemed familiar to the older generation. The answer, of course, is that each individual was his own research center. In the forty or

fifty year span that marks the active period of these men from a single individual has sprung a whole department of workers, from a single pioneer paper has emerged an entire field of scientific work not previously perceived. It has been this proliferating process that extends the fields covered by one worker. For as he built solidly, each operation became a base for others. While Professor Schaffner is not alone in living through this period of expansion, there are few who have led the procession to the various inauguration scenes more determinedly. Here was a man whose observations of minutiae were guided into formulating original and basic principles. His faith in his own endeavors never flagged. His critical judgment directed him to separate false and true leads unhesitatingly. There are several marked instances of this. In the period when cytology occupied Professor Shaffner's early activities the work on the chromosome and its significance was in its infancy. His contributions in this field along with other botanists and zoologists have laid the firm foundation for the chromosome theory and its relation to Mendelism.

The controversy on the inheritance of sex was treated in a most unbiased manner. At the beginning of Mendelian expansion no one thought of sex inheritance. Then came the X Y type of inheritance in *Drosophila*. The suggestions offered do not fit the plant kingdom for most types. Nor is the suggestion of hermaphroditism at all the same as the situation in a heterosporous sporophyte. Schaffner began carefully defining primary and secondary sexual states. He followed this with a straightforward explanation of the difference between factors and their expression. Then began a patient exploration of the nature of sex and the time of its determination in the plant types. A series of experiments and deeply philosophical questionings led to a long series of papers over a period from 1910 to 1937. These may be grouped into three fields: (1) the nature and determination of sex, (2) sex control and sex reversal, (3) rejuvenation. A total of thirty-eight papers in these three fields appeared during the twenty-seven years. Moreover, they opened the way for other workers to see sexuality in a vastly different light and saved many workers the mistake of reasoning by analogy to a false conclusion. As is the only method for extending sure knowledge, an idea represented not a finished accomplishment, but a tool for testing facts and redistributing them.

Teaching beginning students was never the right medium for the effective use of Professor Schaffner's talents. He was likely to be so intent on the problems of the plant as to convey the impression of a wholly disinterested and impersonal attitude toward the class. All topics were of interest to him. Beginning students were unable to grasp the magnitude of the problems spread out before them or to appreciate the amazing accuracy of a difficult vocabulary. It was just the reverse with the advanced students. Each word fitted into its proper meaning with the beautiful logic and precision of the cut facets of a gem. I remember from my own student days that each lecture was a startling revelation of a process that was new to me. It was a process of seeing a person think—not a formalized lecture. Even though his lectures were difficult for beginners, his methods of teaching

were advanced for his day. The diagrams of life cycles have been copied over again and again in many textbooks. His keys to woody plants have never been surpassed in simplicity and directness. In the same fashion, his approach to the understanding of the plant kingdom through a structural taxonomy will be in use for a long time. It was with the keenest delight that he found the confirmation for his classification principles coming from the vastly different approach made by Mez and his co-workers. And I shall never forget having seen the joy with which Mez greeted Schaffner at one of the international botanical congresses, where, after years of correspondence, they met for the first time.

It was the peculiar fate of Professor Schaffner to be highly regarded by the elect among his colleagues, both at home and abroad, but to be unknown to the majority of students on the campus. I doubt if one out of a hundred undergraduates either knew or saw him or was aware of his importance in the study of plants. He was most approachable and genial when sought, but was rarely known to seek diversion or entertainment among his colleagues. Instead, they came to him with questions and always found him ready. He had worked out the answers alone.

Somewhere Mark Hopkins is credited with the thought that the measure of happiness in life is a delicate balance between what one is and what one has. From Professor Schaffner's beginnings as a farm boy on the Kansas prairie with a hard-won battle for education, in which the classics were strongly featured and the religious influence profound, to a great leader in expanding modern botanical science seems a great step. It could not have been achieved by any means but the increasing employment of his talents. And in his long productive career the delicacy of the balance between what one is and what one has was never disturbed. He worked tirelessly because it was in his work he found his greatest happiness.

Our graduate students who enjoyed the opportunity of studying with Professor Schaffner are in agreement that his patient, everlastingly patient, attempt to give to them the insights he possessed into the structures and development of plants is for them a constant inspiration. A single specimen, often hastily glanced at, perhaps discarded, became under his guiding suggestion a new pathway to understanding. Africa has one, China several, India one, and several active centers in the United States have young men who have profited from gifts of wisdom he imparted. Those of us who saw him day after day, constantly at work, but always ready to stop for questions, can never forget his example.

John Henry Schaffner was born in Agosta, Marion County, Ohio. He was educated at Baker University, Kansas; the University of Michigan, the University of Chicago, and the University of Zurich, Switzerland. In 1897, when he came to Ohio State as Assistant in Botany, with the late Dr. Kellerman as Professor, there were fewer students in the whole of Ohio State University, 1,200 or less, than there are now in the Department of Botany each year. Professor Schaffner's work

on chromosome behavior between 1894 and 1898 pioneered in the field that has now developed so richly in the application of Mendelism. His papers on the prairies reflect knowledge acquired during his boyhood familiarity with plants now long gone in regions where they were native. His papers on *Equisetum* cover a whole range of plant sciences focused on the single small group of plants he loved so well to study. His eleventh paper in a series on determinate evolution is just off the press two months after his death. With reference to man, in this paper, there is this sentence, "It has been estimated, on a conservative basis, that there are over twelve billions (12,000,000,000) of cells in the human brain alone, and it is evident that the self-conscious personality, my ego, controls this amazing mechanism and other billions of cells of the body to a definite purpose while this sentence is being written." It is a remarkable sentence in that it contains one of the few personal references in his entire writings. Yet even this slight reference to himself turns out, as the context of the paragraph reveals, to be a means of stating a concept of chromosome activity. He seldom thought of himself. His vacations, always with his family, were visits to Kansas, but for the sake of his children and Mrs. Schaffner as well as for the purpose of collecting specimens they often reached Kansas by way of Maine or the Pacific Coast.

Ohio was not neglected in the matter of plant records. The catalog of Ohio plants is as complete and the herbarium records as numerous as in any state record. Half of these have been added during the last two decades. Perhaps it was the devotion to the herbarium which brought on the heart attack, as it was evident to all of us that the climb of three flights of stairs was a severe strain. When space, more cramped of course than the herbarium, was offered in the basement with the assistants volunteering to do the errand running for changes of specimens to be studied, the answer was only a gentle No, that he preferred to be where all the stored specimens were at hand. The irony of this is that in the original plans for the building in 1914 an elevator to the herbarium was included. For lack of funds at the time this was not installed in the building.

Early in his association at Ohio State University he with the group that numbers Professors Landacre, Herbert Osborn, Raymond Osburn, James Hine, John Bownocker, and others, founded the Biology Club. This grew into the Ohio Academy of Science. Professor Schaffner was the Editor for its entire existence of the Ohio Naturalist, the predecessor of the Ohio Journal of Science. He was also editor of the Ohio Journal of Science from 1916 to 1918, its critical first two years. His services to the Academy in this respect are unique. He was its president in 1919.

We have lost a wise counsellor and a devoted friend. We cannot think of the man without his works, or the deeds without the personality that produced them. A full bibliography of his 330 papers and books will appear in another place. The Torrey Index lacks about a hundred titles of the full citation of his work. As editor, as teacher, as an example of a tireless investigator he leaves us a rich gift in his memory.

Report of the Nominating Committee

For President.....William Lloyd Evans

For Vice-Presidents:

A. Zoology.....John W. Price
B. Botany.....Miss Lois Lampe
C. Geology.....Otto C. Von Schlicten
D. Medical Sciences.....Dr. George M. Curtis
E. Psychology.....Floyd C. Dockeray
F. Physics and Astronomy.....Ray Lambert
G. Geography.....George D. Hubbard
H. Chemistry.....Paul Rothemond
I. Mathematics.....Lewis Brand

For Secretary.....William H. Alexander

For Treasurer.....Eugene Van Cleef

For Elective Members to the Executive Committee.....Claude E. O'Neal, J. Paul Visscher

For Board of Trustees, Research Fund.....Charles G. Shatzer

For Joint Administrative Board, Ohio Journal of Science, A. W. Lindsey

For Committee on Conservation.....A. E. Waller, Chairman; Emery R. Hayhurst; L. E. Hicks; Paul B. Sears; Walter A. Tucker

For Library Committee.....Dr. E. Lucy Braun

For Representative on Save Outdoor Ohio.....Roscoe W. Franks

Respectfully submitted,

(Signed) Harold E. Burtt,
(Signed) W. P. Spencer,
(Signed) R. A. Dobbins,
(Others by proxy and correspondence.—Harold E. Burtt.)

Report of the Committee on Resolutions

Cincinnati, Ohio, April 14, 1939.

Mr. Chairman, Fellow Members of the Ohio Academy of Science, and Friends:

The Committee on Resolutions offers with great sincerity the following:

The Ohio Academy of Science is deeply appreciative of the complete hospitality offered by the University of Cincinnati. Everything has been done for our convenience and comfort. Not only has the University been placed at our disposal, but the city. Members of the Academy appreciate the welcome given them by Taft and Natural History Museums. For these evidences of friendship and hospitality the Academy is most grateful.

Secondly, the task of arrangements is a great and thankless one. We can not reduce the magnitude of the task, but we shall endeavor to

make it less thankless. Be it resolved, then, that Prof. J. Hobart Hoskins and the several members of the arrangements committee be hugely thanked for their effective labors.

A third resolution is hereby offered. Lectures given before the Academy as a whole are most exacting. The variety of interest of the audience demands unusual skill on the part of the lecturer. The Ohio Academy of Science congratulates Dr. Paris B. Stockdale upon his excellent presentation of the Geology of Hawaii, and the Academy finds itself equally indebted to Prof. Edwin L. Moseley for the lecture upon the important question of flood prediction, and Mr. Karl Maslowski for his charming "Naturalist's Diary."

The Fourth Resolution: No one has done more for the popularizing of economic ecological aspects of Botany than Dr. Paul B. Sears. Twice he speaks to the Academy during this session. Twice we are honored.

Respectfully submitted,

ARTHUR T. EVANS, *Chairman*,
CLYDE S. ADAMS,
RODERICK PEATTIE.

A New Treatise on Sedimentary Petrography

The field of sedimentary petrography has undergone notable expansion in recent years, in scope of study and wealth of technique as well as in extent of practice, and for some time there has been need for a thoroughgoing treatise on the subject. The present volume meets this need. It does so especially for methods of mechanical analysis and other treatment of purely physical attributes of sediments, the area in which much of recent progress has centered and for which adequate coverage has not been attempted in any general work hitherto published.

The book is in two parts, the first, by Krumbein, on mechanical analysis and allied subjects, and the second, by Pettijohn, on microscopic, chemical, and other methods. The parts are about equal in length, a proportion to be welcomed by the student especially interested in the mechanical constitution of sediments. On the whole the material is clearly presented and well illustrated, and an outstanding feature of the work is its thoroughness in scope; no important aspect of sedimentary petrography is neglected. It is restricted, however, to method and underlying theory, and no venture is made into the realm of interpretation—doubtless a wise limitation, considering the present status of knowledge respecting the significance of physical features of sediments.

If any major aspect of the book is to be adversely criticised, it is the overthoroughness with which the mathematical and statistical treatments of analytical, data are presented. Much of the first half of the work is devoted to these subjects and some of the discussion is more elaborate than necessary for a book of this sort. The authors are justified in emphasizing these important subjects, but they might have done so at lesser length. For example, in the description of an effective and simple method of graphic differentiation for the determination of frequency distribution curves, mathematical proof is given in full, whereas reference to the easily accessible article in which it has already been published would have sufficed. However, if there is to be error in the matter of completeness, it is far better on the side of amplitude than otherwise.

Especially desirable is the treatment of methods for dealing with sedimentary rocks, which commonly present great difficulty to the laboratory worker, either in disaggregation or in thin-section study; no complete and satisfactory discussion of this subject has hitherto been available in any form.

On the whole this is an excellent book, indispensable to the student of sediments and sedimentary rocks.—*Edmund M. Spieker.*

Manual of Sedimentary Petrography, by W. C. Krumbein and F. J. Pettijohn. New York, D. Appleton-Century Co., 1939. $6.00.

PRESIDENTIAL ADDRESS

CLAUDE E. O'NEAL,
Delaware, Ohio

Coming to Cincinnati is not a new experience to most members of the Ohio Academy of Science. This is our forty-ninth annual meeting and the fourth to be held in what has been called the Queen City of the West. We have learned to expect an inspiration from just coming here. It would be difficult to find a more ideal place for a scientific gathering. The Ohio Valley itself is interesting and the numerous mounds scattered over Hamilton County remind us again of a people who lived here long before the coming of the white man.

From its very founding in 1788 Cincinnati has been known as an educational and industrial center. In its early years it became famous for its art, its literature, its music, and its science. More recently its numerous educational institutions, its newspapers, its publishing companies, its many industries, not to mention its radio broadcasting stations, have reminded us that she still is on the map as a center of industry, culture and refinement. It is good to come to Cincinnati.

And the University of Cincinnati has always opened its doors wide to the scientists of the state and the nation. It has always displayed a co-operative spirit toward scientific investigation, and this has resulted in the kindest feelings on the part of those engaged in scientific work. We thank you for your greetings as well as for the use of your class rooms, lecture halls and equipment. You have made us feel most welcome.

I would like to recall an incident that occurred in your city or very near it, certainly in Hamilton County, 125 years ago. I shall quote from an historical record of that early day. "One of the most wealthy and respectable farmers living near Mill Creek, and who had expended much money in procuring and propagating a fine breed of horses was unfortunate in losing a number of them by distemper which appeared to be of a novel character. As the disease baffled his skill, he soon became convinced that it was the result of witchcraft. Under that impression, he consulted those who had a reputation of a knowledge of sorcery for a remedy for his horses. These persons told him how to discover and how to destroy the witch. One

of the experiments that he was directed to make was to boil herbs and other ingredients in a pot in which he had placed a handful of needles and pins. This, he was told, would cause great mental and physical distress to the witch or wizard. He tried the experiment and while the pot was boiling furiously, he placed himself at the door overlooking the field in which his horses were kept. While in that position he saw his own daughter-in-law, who lived about a quarter of a mile away, hastening to the spring for a bucket of water. His imagination connected her hurried movement with his incantation so strongly that he ordered his son to move his family away from the farm.

"Later, he became of the opinion that a Mrs. Garrison, an elderly woman in feeble health, and who lived some eight or ten miles from his farm, was the principal agent in the destruction of his horses. He frequently expressed this opinion to his neighbors and Mrs. Garrison heard of it and was greatly distressed. . . . One of the charms that he had been directed to use was to shoot a horse with a silver bullet while the witch was evidently in him. He accordingly prepared a silver ball and shot a fine brood mare with it. The horse was killed and a short time later, Mrs. Garrison died. The farmer, we will all agree, believed to his dying day that his silver bullet had killed her."[1]

It is a long throw from such a quag-mire of ignorance and superstition as this to the typing of the pneumococcus and the preparation of the sulfanilamide tablet. It is highly fitting that today one of the outstanding medical schools of the country should be located so near the spot where this pioneer farmer lived and suffered. It is equally fitting, too, that every branch of science represented in our organization should be so adequately cared for on this campus. A long time ago a Great Teacher said, "Ye shall know the truth and the truth will make you free." Truly this has come to pass and is coming to pass in the University of Cincinnati. Doctor Gowdy, we thank you for your greetings.

I should like to take this opportunity to thank all persons who in any way have aided in the work of the Academy during the past year. I refer especially to the officers and the members of the numerous committees, the mere cataloging of which,

[1]Quoted (not verbatim) from Howe's Historical Collections of Ohio, Vol. 1, p. 760.

I fear, may be somewhat boresome. Nevertheless these men have given unstintedly of their time and efforts and appreciation should be shown. The Executive Committee, for example, has held itself subject to call throughout the year and has received and replied to an almost continuous barrage of letters from the President's office. I desire to convey to them my sincere thanks.

TAKING INVENTORY

From time immemorial, business organizations have found it worthwhile to take time out for invoice. Within the recollection of persons here assembled business houses were closed for a time each year, while goods on the shelves were listed and evaluated, bad accounts were written off, and new orders were made out. It would seem that the scientists of the state and of the world could profit by taking a cue from this practice. Certainly they need to know what their assets are, in what direction they are going and what progress is being made.

A casual survey of the field of scientific achievement shows at once that a tremendous volume of facts has been discovered, classified and made available to those who would use it. At no time has the machinery for the dissemination of knowledge been in better condition or so effective. The press, the radio, and the movies can make the result of a scientific discovery or invention common property within a few hours. At no time in the history of the world has the hypothetical man of the street been so well informed of scientific phenomena as he is today. "Those who have eyes to see, may see; and those who have ears to hear, may hear." All of this we may write on the black side of our ledger.

However, when we look at the effect of all of this information and means of ready erudition upon the thinking of the individual and of masses, the picture is not so bright. It would seem that those who are college trained should profit most from the fund of knowledge and should be most influenced by it, yet Everett Dean Martin writes, "The college man shares the usual prejudices of his community. He runs with the crowd after the hero, and shows the same lack of discrimination as do the uneducated. He votes the same party ticket, is intolerant along with his neighbors, and puts the same value upon the material as the illiterate do. His education has made very little difference in his religious beliefs, his

social philosophy, his ethical values or his general outlook on the world. Like all opinionated and half educated people, he jumps to vast conclusions, believes what others believe, does things as others do them, worships the past and idealizes the present."[2]

May I relate a personal incident? A few summers ago I was invited by the director of a boy's camp to take his protegees on a hike. In my preliminary remarks to the boys, I complimented them on the fine appearance of their camp and mentioned particularly some granite boulders which had been arranged in a large circle and painted white, so that the effect was quite like a fairy-ring of giant puff-balls. I told the boys that had the stones been puff-balls and had we been in England or Germany, many people would hesitate to step into the ring for to do so would mean placing themselves under the control of the fairies in England and the witches in case we were in Germany. But, I told them, we were in America and to show them that I was not superstitious, I was going to step into the ring and if any of them were not, they might do so too, and we would start the field trip right. They came with a yell and I as their leader started off on a half run. I had gone perhaps fifty yards when my right foot struck a stone and my right ankle was sprained severely. I tried to catch myself with my left foot, but it landed in a cowtrack and my left ankle also was sprained. I need not describe the rest of the field-trip, but the next day I had a caller, a college graduate of several years standing, who came not so much to express sympathy as to warn me against what he called "the intimidation of unseen forces." When I realized his utter seriousness, I told him that I was of the firm opinion that had I had on my high-topped boots, properly laced, that it would not have happened. His reply was, "Well, anyway, you have been warned." (And this was 115 years after the witchcraft incident, that I mentioned at the outset.)

The college graduate mentioned was not particularly trained in the field of science, but had he been are we sure that his reactions would have been any different? In the circle of my acquaintances is an astrologer who was trained as an electrical engineer. Incidentally, he is making more money from horoscopes than he ever did from wiring dynamos.

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[2]Martin, Everett Dean. The Meaning of a Liberal Education, p. 82. W. W. Norton Co., New York, N. Y.

It would not be easy for this group to come to an agreement upon the ultimate aims and objectives of science or science teaching. I certainly have nothing new to propose along this line, but as long as there is ignorance, superstition, disease, injustice, social inequality, crime, economic mal-adjustments, political chicanery, intolerance and war in the world, there is a place for the scientist and for scientific thinking. This implies that not all scientists can hope to remain or to become laboratory hermits, lost to the world about them. Many have already taken their places in the social order and more should do so with the idea of seeing to it that the methods of science are applied for the good of all mankind.

In 1938, the British Association for the Advancement of Science, at its annual meeting, voted to establish a division to deal with the social and international relations of science. "The main purposes of the Division are to further the objective study of the effects of advances in science in communities and reciprocally the effects of social conditions upon the progress of science; and, to encourage the application of science to promote the well-being of society."[3] (The improvement of international relations is considered a social problem.) Already the British Association has made wide contacts with scientists of various countries and lay interests in the work of the Division. Of course, this is just one straw, but it may indicate the direction toward which the scientific wind is turning.

Science has done much to ameliorate the needs and hardships of mankind, and this work must continue; but as time goes by, it seems likely that it also will have to indicate the means whereby its blessings may be made more generally available to all.

And, now, if we may come a little nearer home, let us glance at the status of the science work that is being done in Ohio. Much of this work is carried on in the colleges and universities with which the state is so abundantly provided. Most of us in the smaller institutions are ready to confess that we are not doing as much first hand investigating as we should. We are inclined to plead the excuse of too many classes, too many committee meetings, too many social engagements, too many interruptions, and general lack of atmosphere. In the larger institutions enormous classes, heavy teaching loads, and some-

[3]From a brochure published by the British Association for the Advancement of Science.

times crowded quarters and lack of funds make for a situation almost equally difficult. As a result the question might be raised as to whether or not a too-high percentage of our scientific work is being done as theses requirements for advanced degrees. Be that as it may, progress is being made and will continue to be made in the state of Ohio.

The Ohio Academy of Science is the one outstanding scientific organization in our state which attempts to bring together in a single body the workers in the various fields of endeavor. Reasonably, it might be expected to appeal to nearly everyone working in the field of science within our boundaries, but for the last twelve years, our membership has just about held its own. At the 37th annual meeting the statement was made that we had slightly over 500 members. A similar statement could have been made at the beginning of this year. Someone may say at once that we are large enough, and possibly this is correct, but the state just west of us with many less colleges and universities as well as large cities, supports an Academy of about 900 members.

It may be beyond my ability to determine the reasons for this discrepancy, but as a member of both organizations, I should like to point out certain obvious facts. First, there is a more wide spread interest on the part of the young scientists in Indiana in becoming members of their Academy. Possibly this is due to the fact that they have a junior membership who at a tender age become interested and later full-fledged members. I am pleased to note that we are taking steps in this direction at our forty-ninth meeting. Our sister Academy has kept its membership fee at $1.00 and the papers read before it are published in a single bound volume.

It may be argued that anyone can pay $2.50 per year for membership, but in these days of curtailed incomes, it is more difficult for many people to justify even this small expense. This is especially true of the younger group from which our new members logically should come.

During the present year the Executive Committee instigated a campaign to increase our membership. You have heard the slogan that was adopted, "One thousand members by 1940." This is not an impossible goal, if we can assure the incoming members that they will receive full value for the $2.50 which they give us. To do this will require the wisest counsel which we can afford, as well as the co-operation of our entire present

membership. And, I wish to say right here, that we are very fortunate in having Dean Arps as a member of the Ohio Academy of Science. We are doubly fortunate in that he has agreed to act as the Director of our Semi-Centennial Celebration. He already has his shoulder to the wheel and it is beginning to turn. He needs and expects the co-operation of each of us. In a few minutes Dean Arps will tell us of the plans for our Semi-Centennial Celebration. This celebration as well as at least two other meetings of national note to be held in our state next year should aid very materially our drive for new members.

In passing, may I express the opinion that the Academy has not received the publicity in the past which the interest and importance of the papers presented before it have justified. We have just about discontinued the practice of requiring abstracts before papers are read. Yet, if this were done, a copy could be sent to Science Service, Washington, D. C. This agency welcomes such material but agrees to use only that which is of general interest. Another copy could be sent to the local press representatives in the city in which the meeting is held. A third copy should be reserved for filing. It will be noted that this suggestion does not involve the expenditure of money, and is already being followed by other Academies.

The man in our organization who probably knows most about administrative matters says that what the Ohio Academy needs worst, is a good administration. After my year's experience, I am inclined to agree, but would like to point out one procedure in our set-up which makes it very difficult of fulfillment. In the past your President has had to assume executive duties immediately upon election. There is no objection to this practice, if the man elected is conversant with the intimate workings of the organization, but it frequently happens that he is not. This condition could largely be obviated by electing our President a full year ahead and asking that he serve on the Executive Committee for the intervening period. Other possibilities of improvement will occur to the members of the Council as they study our best interests.

In conclusion, let me say that I have no fears for the scientific progress of the future. The eternal question mark in the mind of man will care for that; and for the Ohio Academy of Science I dare predict a wider sphere of usefulness as the years go by.

LONG TIME FORECASTS OF OHIO RIVER FLOODS

E. L. MOSELEY,
Bowling Green State University
Bowling Green, Ohio

Had we known ten years ago what we know now about cycles of precipitation we could have predicted heavy rain for the Ohio valley in the winter of 1936–'37. That the most disastrous flood in its entire history would come at that time we could not have foreseen.

The amount of destruction wrought by a flood depends on many things besides the amount of rain at the time. Nevertheless, major floods in the Ohio River have probably rarely, if ever, occurred without more than the average amount of rain over the drainage area of some of its tributaries not very long prior to the flood. Heavy precipitation is a major factor in flood production.

Twenty-nine times in the past eighty years the gauge at Cincinnati has shown the river to be more than 55 feet above the zero mark. This occurred once in August and once in December, but 27 of these 29 floods occurred in the first third of the year—6 in January, 9 in February, 8 in March, 4 in April. In predicting major floods a knowledge of prospective rainfall in spring and summer is of less importance than that of winter. If heavy summer rains keep the ground wet until late fall, less rain will be needed later to start the water flowing in drain tile and ditches, but the amount of precipitation in late fall and in winter is of more importance in flood production.

There have been periods of several years without great floods and periods of similar duration with several great floods. The Annual Meterological Summary for Cincinnati gives the highest stage of the river for every year from 1867–1937. Within this time the river was above 55 feet 24 times, but only eight times in isolated years. The other 16 floods occurred in years that were just before or just after a flood year. Thus there was a major flood in 1882, in 1883, and in 1884, also in 1897, 1898, and 1899. The Pittsburgh record shows the same thing; major floods occurring singly were much less numerous than those occurring in successive years.

We have good reason to believe that variations in the emission of solar energy, both in total quantity and in the

proportional amount of ultraviolet rays, are in some way responsible for at least a part of those changes in the terrestrial atmosphere which we commonly speak of as weather. How they influence weather is not yet well understood. Quite likely the sunspots themselves do not play an important part, but their presence in large numbers indicates increased activity in the solar atmosphere, accompanied by emission of more heat. Strange to say our thermometers at such times register lower temperatures. This paradox is not so easily explained as the fact that our winter comes when the earth is nearest the sun, for the lowering of temperature at times of sunspot maxima is not confined to either hemisphere. The increased heat from the sun causes more storms with attendant clouds that intercept part of the sun's rays before they reach the solid earth. These storms also cause an overturning of the atmosphere resulting in a mingling of cool air from above with the air near the earth's surface.

Just as a violin string vibrates as a whole and at the same time in parts, so the curve representing the sunspot numbers shows a fundamental period and other periods which may be called harmonics. The fundamental, although variable, averages more than eleven years. Corresponding to this period I have found variations in rainfall in the Ohio valley. In arid regions of the Southwest, where rain is the all-important factor in tree growth, Professor Douglass of the University of Arizona has found that not only the fundamental but also the harmonics in the curve of sunspot numbers show in the tree rings.

Each of these short periods in the sunspot curve probably has some influence on our weather. Their combined effect at any particular time depends on the phases which come together at that time. This changes from year to year, but since the fundamental and the harmonics are all submultiples of about ninety years they combine again after this interval in the same phase as at the beginning.

Professor Kullmer of Syracuse University has found that the centers of greatest storminess over the United States and Canada shift in both latitude and longitude. After moving east for a number of years the location of these centers returns abruptly to a position much farther west. It may be that after ninety years the storm centers return to very nearly the same place which they had at the beginning. The data available for his charts do not cover a long enough period yet to tell whether there is a basis of fact in this hypothesis.

My early work with tree rings consisted mainly in laying off 46-year periods, later changed to 45-year periods, and measuring the radial growth increment during each of these periods. The period starting with 1891 I called Period 1, the preceding 45 years Period 2, and so on. I found that in Period 2 a majority of trees made more growth than in Period 1 or 3, and that all even numbered periods were wet ones, odd numbered periods, with one exception, dry ones. Consequently twice 45 years takes us from the beginning of one wet period to the beginning of another wet period, and likewise from any part of any period to the corresponding part of another similar period.

Thus there are some theoretical grounds for the idea that precipitation in any given region in this part of North America comes in ninety-year cycles. That there actually is a repetition of drought and flood after the lapse of about ninety years we have abundant evidence. It comes from four sources: Great Lakes levels, tree rings, high and low water in rivers, and actual records of rainfall. Early records of unusually high or low water in the Great Lakes are scanty. More of them relate to Lake Ontario than to any other lake, for on its shores there were settlements earlier than about the lakes farther west. Since it receives most of its water from the other lakes its level is an index of rainfall over a large area. When it was unusually high this was noticed and in some cases a record made of it. About ninety years after each of these early years of high water in the Great Lakes there was high water again.

On the terminal portion of the Cedar Point peninsula, which lies between Sandusky Bay and Lake Erie, are long parallel ridges formed of gravel and sand. Each ridge was built by a great northeast storm occurring at a time when Lake Erie was unusually high. Only at such times was it possible for the wind to drive the waves far back on the land and throw up ridges which would not be demolished by a later storm. Early in the present century, accompanied by boys from the Sandusky High School, I made many trips to Cedar Point for the purpose of determining when these ridges were formed. The methods we employed and the dates which we finally assigned as a result of this research were made known to the Ohio Academy of Science at its annual meeting in Cleveland in 1904.[1] Two of the ridges were formed in the nineteenth

[1]Thirteenth Annual Report, Ohio Academy of Science, pp. 223–231.

century, one in the eighteenth, one in the seventeenth, two in the sixteenth and one in the fifteenth.

The dates which we assigned to the ridges that were built in the nineteenth century we had reason to believe were correct within two or three years. We did not suppose that such close approximation was true also of the dates of ridges formed in the earlier centuries. Not until recently did I know anything about cycles of precipitation. In view of this fact it is significant that a succession of ninety-year intervals is clearly shown by these dates. Three of the dates are 1504, 1594 and 1684. Ninety years later no permanent ridge was formed, but 180 years later, 1864, is very close to the time that ridge 6 B was formed, 1861 or 1862. The date assigned to the oldest ridge is 1429. Five times 90 (450) years later is 1879. The date assigned to the latest of these permanent ridges is 1878.

A living tree forms a new ring of wood each year just beneath the bark. These annual rings, as they are called, show by their thickness whether the tree was getting more or less than the usual amount of moisture at the time the ring was formed. A study of these rings after the tree is cut down makes it possible to learn about the rainfall during the life of the tree. I have made measurements on the tops of stumps, the ends of logs, or on cross sections taken from them, representing more than four hundred large trees that grew from southern Michigan to central Tennessee. A large part of these trees were between 200 and 370 years old, a few were still older and so afford information about the rainfall each year for the past four centuries. They show plainly a tendency to repeat after about ninety years.

The dates when the trees formed rings which were obviously wider or narrower than neighboring rings were recorded for about 125 trees, of which a large majority were oaks. These records form the basis for the table of wide and narrow rings. (See Table I.)

Records of Ohio River floods at Pittsburgh go back to 1762, which is 26 years before there was any permanent settlement in Ohio. Until after 1832 there were only seven floods so important that they are shown on this record. Each of these was followed by a flood approximately ninety years later, the water usually reaching a height similar to that of the earlier flood. There were six floods in the years 1846–'52; no

other comparable period in the nineteenth century had so many floods when the Ohio River reached such high levels. This corresponds to the period 1936–1942, which has already given three major floods.

TABLE I

YEARS WHEN A MAJORITY OF THE TREES IN THE REGION EXTENDING FROM SOUTHERN MICHIGAN TO TENNESSEE FORMED WIDE OR NARROW RINGS

WIDE			NARROW			
1852	1761	1671	1936	1845	1755	1665
1850	1760	1669	1934	1843	1753	1663
1939 (?)	1849	1759	1668	1931–2	1841	1751	1660
1938	1848	1758		1930	1839	1748–9	1658
1937	1847	1756		1925	1834	1743–4	1652–3
1928	1837	1747	1657	1911	1821	1730	1640
1927	1836			1910	1820	1729(?)	1639 (?)
1922	1832	1741		1907	1816	1726	1636
				1901	1811	1721	1630
	1887	1797	1707	1900	1810	1720	1629 (?)
	1886	1796	1706	1898–9	1808–9	1718	1628
	1885	1795	1705	1895	1804	1714	1624
	1884	1794	1704	1894	1802–3	1712–3	1622–3
	1883	1793	1703	1891	1801	1711	1620
	1881	1791		1890	1799–0	1709–0	1618–9
	1878	1788	1697 (?)	1874	1784	1693	1603
	1877	1787	1696	1871	1781	1691	1600
	1876	1786	1695	1870	1780	1690	1599
	1869	1779(?)	1688	1868	1778	1687	1597
	1859	1769	1678	1867	1777	1686	1596 (?)
	1858	1768	1677	1864	1774	1683	1592
				1857	1767	1676	1585
				1856	1766	1675	1584

The table shows that each wet year was followed after an interval of 90 or 91 years by another wet year, likewise each dry year by a dry year. If the precipitation cycle were as long as ninety and one-half years, the 91-year interval would appear as often as the 90-year interval, but it does not. If the cycle were just ninety and one-third years, then after three such intervals the difference between dates would be 271 years, as it usually is, but in some cases it is 272 years, which implies that the cycle is a little more than ninety and one-third years.

By using records of rainfall prior to 1848 many attempts have been made to correlate months of excessive or deficient rain with months between 90 and 91 years later. The best correlations were found by using the months ninety years and five months later, the next best by using an interval of ninety years and four months. This result is in good agreement with the table of dates of wet and dry years shown by the width of tree rings. Both methods lead to the conclusion that the length of the cycle is not far from 90.4 years.

The first two floods recorded at Pittsburgh, 1762 and 1763, were among the greatest in the entire record. Ninety years after 1762, that is in 1852, the river at Pittsburgh rose to 35.1 feet, almost as high as in the great flood of 1884, and higher than at any other time in the century preceding 1936. It lacked only one foot of attaining the same height a few months earlier, September, 1851. This is the only time that two such

Bur oak stump 47″ × 52″, 30″ high, Allen county, Indiana, May 2, 1939. It shows 283 annual rings.
Photo by O. E. Ehrhart, Antwerp, Ohio.

high floods have occurred there within so short a period in the entire 175 years of the Pittsburgh record. Ninety years after 1852—twice ninety years after 1762—will be 1942. Farther on we will consider the probability of a great flood then.

Tree rings show that there were copious rains over a wide area in the years 1846–'52, also in 1756–'62, and 1666–'72, that is at intervals of ninety years.

These great floods of course affected the river also along the West Virginia, Kentucky, and Ohio border, where there are records of a few other early floods. At Cincinnati the highest water that old residents could remember prior to the flood of 1937 came in 1883 and '84. Each of these great floods followed ninety-one years after a great flood; that of 1792 reached a height of about 63 feet, that of 1793, 57 feet. Tree rings for all four of these great flood years have been observed on stumps and logs in seven states; they all show heavy rainfall. Ninety years earlier still, 1702 and '03, a majority of the trees produced wide rings.

We are now ready to see how this tendency of heavy precipitation to repeat itself after 90.4 years might have been used in predicting recent floods. Let us consider first the rainfall 90.4 years prior to the terrible flood in January, 1937. This takes us back to the summer of 1846. That year the rainfall at Cincinnati and Dayton was above normal every month from April to August; in some of these months it was very much above normal, double or nearly double. Marietta had over 19 inches of rain in three months, June, July, and August. Steubenville, still farther up the river, had 22.79 inches in four months, May to August. Pittsburgh had double the normal amount, July and August. Portsmouth, Ohio, and Springdale, near Louisville, Kentucky, also had heavy rain at that time. Such rain in the summer of 1846 would have justified predicting a serious flood in the Ohio River in the winter of 1936–'37.

The great flood of 1936, which at Pittsburgh was even greater than that of 1937, came two months later in the year than that of 1937, as might have been expected from the fact that heavy rain in 1845 started later and continued later. That year Cincinnati had 11½ inches of rain in June and 14.39 inches in the two months August and September.

In 1847 there was a surplus of rain along the Ohio River from Pittsburgh to Louisville in June and July, likewise 90.4

years later, October and December, 1937. There would have been a flood in January or February, 1938, if heavy rains had continued, but in August, 1847, rainfall was below normal, likewise in January, 1938, it was below normal. So 1938 did not, like the preceding years, give a major flood.

The year 1848, like the years before and after, gave more than the usual amount of rain in the Ohio valley. There was a large surplus in May and a very large one in July, followed by a surplus of one inch in August. 90.4 years later came the winter of 1938–'39, with a flood which drove many thousands of people from their homes.

Every major flood which has occurred from 1913 to the present was preceded by heavy precipitation about 90.4 years before. Marietta is the only Ohio River station whose record goes back 90 years earlier than 1913. It had almost double the usual amount of rain in September, October and November, 1822. The tree rings formed in 1822 and 1823 indicate that more rain fell in those years than in any two previous years in the century.

In September, 1848, rainfall in the Ohio valley was below normal, in October and November it was about normal. The corresponding part of 1939 is from February, or a little before, to about the present time. December, 1848, brought heavy rains all along the Ohio River, also in western New York, central Pennsylvania, eastern Missouri and Iowa. At Cincinnati and Springdale there was more than ten inches. The following month the rainfall was not so great but, nevertheless, was double the normal at Cincinnati, Dayton, and St. Louis, and above normal at most places. We may expect heavy rains in the next two months.

In February, 1849, at a majority of places in this part of the country rainfall was below normal, in March it was well above, in April, May and June it was near normal. Accordingly we may look for about the average amount of rain in the five months, July to November, taken as a whole.

July, 1849, gave a very heavy rain—on an average more than nine inches at Dayton, Cincinnati, Portsmouth and at St. Louis, Missouri; but in eastern Ohio, Pennsylvania and New York rain that month was below normal. About December, 1939, rain should be heavy from Cincinnati to St. Louis. In August, 1849, rain averaged about normal along the Ohio River, in September rain was light at all stations, in October

it was about double the normal at some stations, in November it was below. Judging from these data I think there will not be a major flood in the Ohio River in the early part of 1940. The Mississippi River will be unusually high above St. Louis and perhaps also farther south, throughout much of the winter of 1939–'40.

In 1850 the rainfall at Cincinnati was 54.56 inches, exceeding that of any year since. Portsmouth had 57.20 inches, which is more than in any other year in its entire record of over a century. Springdale, Kentucky, had still more rain that year, 67.10 inches, which was also its maximum. 1850 was a wet year also in the Eastern States. All along the Ohio River there were excessive rains the last month of 1849 and the first part of 1850, continuing through March at most places. So we may expect copious rains, May to August, 1940. If great floods in this river were not so rare in summer, I would expect one in the summer of 1940.

In the summer of 1850 rainfall was heavy at Cincinnati and Springdale, but not along the upper course of the river. There is not likely to be a major flood in 1941.

Rainfall was double the normal in December, 1850, at four of the six stations along the Ohio River, but in nearly every month of 1851 it was below normal at all stations. Therefore we may expect less rain from June, 1941, to May, 1942, than in any other twelve month period in the seven wet years which began late in the summer of 1936. This does not mean, however, that there will be a drought at that time.

In 1942 the river should rise in July and August and become high in September. During the remainder of the year rainfall should not average much, if any, above normal.

Since there was a great flood in 1762 and another in 1852, we might expect another about 1943. Let us consider the probability of it on the basis of rainfall in 1852. In July it was below normal at all Ohio River stations, in August and September about normal, in October below normal at all stations. Hence December, 1942, and the first three months of 1943, taken as a whole, should not have precipitation above normal.

November precipitation in 1852 was well above average in four places on the river and at Richmond, Indiana, whose record started with that year. In the following month Richmond had 11.20 inches, or four times the normal. At other

places the average was about double the normal. Hence the river should rise in April, 1943, and in May become unusually high for that month.

In 1853 average precipitation was low at Ohio River stations, also in 1854 in part of them, in summer low at all of them. It was also rather low in the first four months of 1855. Hence there should be no very high water after the spring of 1943 until late in 1945.

In the summer of 1855 rainfall was excessive all along the river from June to September, at some places also in May. This implies high water from November, 1945, to February, 1946. If much of the precipitation in early winter falls as snow that remains long on the ground, there will be a flood when it melts if a large amount melts in a short time.

There will be high water at this time also in Pennsylvania, New York, and northern Ohio, resulting in floods, especially if much snow melts quickly.

After the spring of 1946 until late in the following year we think there will be no great floods in large streams in southern Wisconsin, eastern Iowa, Illinois, Indiana, Ohio, Kentucky, Pennsylvania, or New York.

In the spring of 1946 there should be abundant rain for crops that mature before mid-summer, but after that we may expect a drought that will continue until late in 1947. This drought will be of wide extent, in this part of the continent, but will not be felt everywhere. Tree rings show that the growing season of 1856 was dry from Michigan to Tennessee, in many places very dry. Weather records at those places in this area where the year 1856 is included show the same thing. Nearly all the trees show a narrow ring also in 1766, which was ninety years earlier. Ninety and ninety-one years before that, the growing seasons of both 1675 and '76 were dry. In 1584 and '85 the trees formed rings that were very narrow.

In 1856, which over a large area was one of the driest years of the nineteenth century, New Orleans and Baton Rouge each had 67 inches of rain. More than usual fell also at St. Louis, Missouri, Fort Madison and Monticello, Iowa, Kearney, Nebraska, Leavenworth, Kansas, and Fort Gibson, Oklahoma. Rainfall was below normal at other places in Iowa and much below in southeastern Texas, Pennsylvania and parts of New York State.

There will be plentiful rain again in 1948, 1949, and indeed in a majority of the years until the last quarter of the century.

In summary, nearly all of the great floods of the Ohio River have occurred in the first third of the year. Excessive precipitation 90.4 years later falls in summer. Nevertheless floods early in the year are likely to recur after ninety or ninety-one years, because precipitation oftentimes is high not only at the time of the flood but also in the summers preceding and following the flood. Wet years, like the floods themselves, show a tendency to occur in groups.

There will be high water in the river several times before the middle of 1943. These include May and June of the present year, the summer of next year, the latter part of summer in 1942, and the spring of 1943. In the five years following the spring of 1943, if a great flood occurs, it will probably be in the winter of 1945 to '46.

Quantum Mechanics

A feeling is rapidly crystallizing itself among the physicists in our colleges and universities that a graduate student should as early as possible be given an introductory knowledge to quantum mechanics in order that he may make use of it in his other work. Recognition of the fact that classical physics is inadequate for the treatment of problems throughout atomic and molecular physics almost forces this point of view upon one. One is moreover nearly compelled to recognize that to the beginner it is more important to make use of the formulation of the new mechanics to work out problems in modern physics than it is to know the entire philosophical background for it. The student in elementary physics is not at once taught the philosophical structure underlying the Newtonian mechanics, but is made to work problems concerning pulleys and levers. It seems reasonable to start the beginning student in modern physics by working simple problems rather than with the uncertainty principle.

The Introduction to Quantum Mechanics by Rojansky is written from this point of view. It assumes as a prerequisite only the elements of the calculus and the ordinary differential equations. It is not given over to rigorous proofs or derivations, but aspires rather to give a plausible presentation of the point in question. It is not a book for the advanced student in quantum mechanics, although even he will often find it useful, but is written definitely for the beginning graduate student.

In the chapters I and IX are treated the more mathematical aspects of the quantum mechanics, while chapters II–VIII and X, XI treat one dimensional problems in quantum theory. In these chapters the problems are reviewed from the classical method of approach and subsequently in the Schrödinger, Heisenberg and Dirac formulations. Chapter XII is devoted to three dimensional problems and in the last two chapters the Pauli and Dirac theories of the spinning electron are discussed. Each chapter contains a list of carefully chosen problems and exercises to illustrate the reading material of the chapter.

This work seems to fill a demand which has long existed and it can be sincerely recommended as a text for courses in elementary quantum mechanics. It should prove useful to many others, especially to experimenters for whom it is important to have at least a general knowledge of the theory.—*H. H. Nielsen.*

Introductory Quantum Mechanics, by Vladimir Rojansky. x+544 pp. New York, Prentice-Hall, Inc., 1938. $5.50.

ADDITIONS TO THE REVISED CATALOGUE OF OHIO VASCULAR PLANTS. VII*

JOHN H. SCHAFFNER and CLYDE H. JONES

Our enthusiastic amateur botanists have contributed their usual large number of specimens during the past year. These contributions have greatly augmented our knowledge of the diversity and the distribution of the flora of Ohio.

The work performed by a number of N. Y. A. students has been very important from the standpoint of preserving the many valuable contributions donated by collectors through the years. The extermination of insects, replacing of illegible labels, and the cleaning and repairing of damaged herbarium sheets are a few of the many tasks performed by these students. Our State Herbarium is one of the best, and no effort should be spared to maintain that status.

The plants included in the following list were selected by Professor Schaffner from the contributions of the past year which he had examined. The unexamined collections will, undoubtedly, yield many more important and interesting records which will be given proper recognition in next year's report. The contributions so far examined have brought to light 10 species new to the state and important range extension of 59 others.

A recent survey of the 2,488 species, represented by 55,000 sheets in the State Herbarium, indicates that there are 536 species which have been reported from less than five counties in the state. A list of these species will soon be available to collectors and should be an aid in establishing authentic records of the true status of our rare or seldom collected native vascular plants.

1. *Ophioglossum vulgatum* L. Adder-tongue. Athens Co. Walter P. Porter and P. S. Wamsley.

25a. *Asplenium platyneuron* x *Camptosorus rhizophyllus* (*A. ebenoides* Scott). Muskingum Twp., Washington Co. George R. Procter. In Marietta College Herbarium.

51. *Isoetes engelmanni* A. Br. Engelmann's Quillwort. Pleasant Twp., Clark Co. Clyde H. Jones.

82.1. *Sagittaria longirostra* (Micheli) J. G. Sm. Long-beaked Arrow-head. Along Maumee R. near Napoleon, Henry Co. Floyd B. Chapman and L. E. Hicks.

113. *Naias gracillima* (A. Br.) Magnus. Thread-like Naias. In quiet pool of Portage River, Ottawa Co., probably near Port Clinton. In University of Michigan Herbarium. A. J. Peters (1898). Reported by Carl O. Grassl.

114.1. *Cabomba caroliniana* Gr. Cabomba. Holden Arboretum, Buttonbush Bog, Kirtland Twp., Lake Co. J. W. Aldrich.

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*Papers from the Department of Botany, The Ohio State University, No. 419.

119.1. *Anacharis planchonii* (Casp.) Rydb. Narrow-leaf Water-weed. Lake Alma, Jackson Co. Harold L. Edmonds.
122. *Sparganim androcladum* (Engelm.) Morong. Branching Bur-reed. In Buttonbush Bog, Kirtland, Lake Co. J. W. Aldrich.
166. *Stenophyllus capillaris* (L.) Britt. Hair-like Stenophyllus. Sandy Springs, Adams Co. F. B. Chapman.
157. *Dulichium arundinaceum* (L.) Britt. Dulichium. In bog, Madison Twp., Scioto Co. Floyd B. Chapman and Conrad Roth.
171. *Cyperus ovularis* (Mx.) Torr. Globose Cyperus. Common on sand ridges, Liberty Twp., Wood Co. R. E. Shanks.
225. *Carex cephalantha* (Bail.) Bickn. Little Prickly Sedge. Lake-O-Springs, Jackson Twp., Stark Co. Don M. Brown.
305. *Carex cryptolepis* Mack. Small Yellow Sedge. Lake-O-Springs, Jackson Twp., Stark Co. Don M. Brown.
325. *Arundinaria tecta* (Walt.) Muhl. Cane. Spreading from clumps planted many years ago. Section 18, Berne Twp., Fairfield Co. Lewis K. Cook. and Franklin, Jackson Co. A. L. Pierstorff.
339. *Festuca shortii* Kunth. Short's Fescue-grass. Circleville Twp., Pickaway Co. Floyd Bartley and Leslie L. Pontius.
355. *Poa autumnalis* Muhl. Flexuous Spear-grass. Cadiz Twp., Harrison Co. Edward S. Thomas.
394. *Sporobolus clandestinus* (Spreng.) Hitchc. Rough Rush-grass. Along B. & O. R. R. track near New Vienna, Clinton Co. Katie M. Roads.
403.1. *Agrostis palustris* Huds. Creeping Bent-grass. Sugar Run, Ross Co. Gordon S. Crowl.
478. *Panicum leibergii* (Vasey) Scribn. Leiberg's Panic-grass. Deer Creek Twp., Pickaway Co. Floyd Bartley and Leslie L. Pontius.
488. *Panicum lindheimeri* Nash. Lindheimer's Panic-grass. Deer Creek Twp., Pickaway Co. Floyd Bartley and Leslie L. Pontius.
493. *Panicum meridionale* Ashe. Matting Panic-grass. Liberty Twp., Wood Co. R. E. Shanks.
536. *Allium cepa* L. Common Onion. On railway embankment. Columbus, Franklin Co. John H. Schaffner.
537.1. *Allium sativum* L. Garlic. Common along the Danville Road near Hillsboro, Highland Co. Katie M. Roads.
552. *Stenanthium robustum* Wats. Stout Stenanthium. On steep hillside, open field. Gallia Co. Leslie L. Pontius and Floyd Bartley.
597.2. *Juncus vaseyi* Engelm. Vasey's Rush. In pastured woods. Perry Twp., Shelby Co. R. E. Shanks.
603. *Juncus articulatus* L. Jointed Rush. Mentor, Lake Co. Don M. Brown.
606. *Juncus brachycarpus* Engelm. Short-fuited Rush. Plain Twp., Wood Co. R. E. Shanks.
614. *Xyris torta* Smith. Slender Yellow-eyed-grass. In a bog, Madison Twp., Scioto Co. Floyd B. Chapman.
616. *Manfreda virginica* (L.) Salisb. False Aloe. About 100 plants in southwestern New Market Twp., Highland Co. Katie M. Roads.
669. *Tipularia unifolia* (Muhl.) B. S. P. Crane-fly Orchis. Waterloo Forest, Athens Co. Walter P. Porter.
678. *Magnolia aciminata* L. Cucumber Magnolia. Perry Co. Edward S. Thomas.
685. *Ranunculus pennsylvanicus* L. f. Bristly Buttercup. Urbana Raised Bog. Urbana Twp., Champaign Co. Margaret B. Church.
725.1. *Thalictrum caulophylloides* Small. Cohosh Meadow-rue. Clifton Gorge, Greene Co. Leslie L. Pontius and Floyd Bartley.
745. *Papaver rhoeas* L. Field Poppy. Hundreds in the tall grass along the road half way between New Antioch and New Vienna, Clinton Co. Katie M. Roads.
762. *Berteroa incana* (L.) DC. Hoary Berteroa. Cadiz, Harrison Co. V. G. Applegate.
812. *Arabis virginica* (L.) Trel. Virginia Rock-cress. Athens Twp., Athens Co Walter P. Porter and P. S. Wamsley.
830. *Leavenworthia uniflora* (Mx.) Britt. Michaux's Leavenworthia. Lynx, Adams Co. Floyd B. Chapman.
855. *Erodium cicutarium* (L.) L'Her. Stork's-bill. Plentiful in fields. Buchtel, Athens Co. Len. Stephenson.

884. *Polygala cruciata* L. Cross-leaf Milkwort. Liberty Twp., Wood Co. R. E. Shanks.
885. *Polygala ambigua* Nutt. Loose-spiked Milkwort. Mew Market Twp., Highland Co. Katie M. Roads.
896. *Tithymalus lathyrus* (L.) Hill. Caper Spurge. Spontaneous at Grandview, Franklin Co. Wendell Paddock.
914. *Callitriche heterophylla* Pursh. Larger Water-starwort. Near Zaleski, Vinton Co. Walter P. Porter.
924. *Sida hermaphrodita* (L.) Rusby. Tall Sida. Along Ohio River. Green Twp., Scioto Co. Conrad Roth and Floyd B. Chapman.
976.1. *Viola primulifolia* L. Primrose-leaf Violet. Madison Twp., Scioto Co. Floyd B. Chapman and Conrad Roth.
977. *Viola lanceolata* L. Lanceleaf Violet. In a bog, Madison Twp., Scioto Co. Floyd B. Chapman and Conrad Roth.
992. *Sagina procumbens* L. Procumbent Pearlwort. Athens, Athens Co. Walter P. Porter.
1024. *Silene rotundifolia* Nutt. Roundleaf Catchfly. Chimney Rocks, Pike Co. Gordon S. Crowl.
1147. *Fragaria vesca* L. European Wood Strawberry. Established accidentally in the edge of a large flower bed. Hillsboro, Highland Co. Katie M. Roads.
1155.1. *Rubus argutus* Link. Tall Blackberry. Coleraine Twp., Ross Co. Donald McBeth.
1337. *Heuchera villosa* Mx. Hairy Alum-root. Perry Twp., Lawrence Co. F. B. Chapman and Conrad Roth.
1477. *Salix candida* Fl. Hoary Willow. In a swamp near Hudson, Portage Co. Floyd Bartley and Leslie L. Pontius.
1497. *Grossularia reclinata* (L.) Mill. Garden Gooseberry. Along the road. Liberty Twp., Highland Co. Katie M. Roads.
1526. *Cucurbita lagenaria* L. Bottle Gourd. A large patch in a pasture lot near New Vienna, Clinton Co. Katie M. Roads.
1545. *Xolisma ligustrina* (L.) Britton. Xolisma. Springfield Twp., Gallia Co. Clyde H. Jones.
1553. *Chimaphila umbellata* (L.) Nutt. Pipsissewa. Liberty Twp., Wood Co. R. E. Shanks.
1592. *Convolvulus fraterniflorus* Mack. & Bush. Short-stalked Bindweed. Near New Vienna, Clinton Co. Katie M. Roads.
1611.1. *Buddleia davidi* Franch. Butterfly-bush. In a dense weed patch in the basement of a burned-down factory. Hillsboro, Highland Co. Katie M. Roads.
1613.1. *Ligustrum obtusifolium* S. & Z. Blunt-leaf Privet. Three large bushes along a small wooded stream near Blanchester, Clinton Co. Katie M. Roads.
1625. *Gentiana procera* Holm. Smaller Fringed Gentian. Greene Twp., Ross Co., and Deer Creek Twp., Pickaway Co. Floyd Bartley and Leslie L. Pontius. Also south of Rock Bridge, Hocking Co. Mrs. C. G. Landis and Mrs. Wm. Halenkamp.
1660.2. Petunia hybrida Vilm. Common Garden Petunia. Escaped in a pasture lot, Hillsboro, Highland Co. Katie M. Roads.
1756. *Utricularia gibba* L. Humped Bladderwort. Athens State Hospital Lakes, Athens Co. Walter P. Porter.
1774. *Lithospermum carolinense* (Walt.) Mack. Hairy Puccoon. Plain Twp., Wood Co. and Washington Twp., Henry Co. R. E. Shanks.
2076.1a. *Bidens polylepis retrorsa* Sherff. Large-bracted Tickseed. Porter Twp., Scioto Co. Conrad Roth.
2101.1. *Tagetes patula* L. French Marigold. Along the N. & W. R. R. track. Hillsboro, Highland Co. Katie M. Roads.
2102.1. *Calendula officinalis* L. Pot-marigold. In a vacant lot in Hillsboro, Highland Co. Katie M. Roads.
2143. *Bellis perennis* L. European Daisy. Common in lawns and lawn-extensions. Wooster, Wayne Co. John H. Schaffner.
2189. *Eupatorium serotinum* Mx. Late-flowering Thoroughwort. Swamp along Black Fork Creek, Jackson Co. Floyd Bartley and Lester L. Pontius. Also Greene Twp., Scioto Co. Floyd B. Chapman and Conrad Roth.
2285.1. *Crepis pulchra* L. Small-flowered Hawksbeard. Along railway track, Penn Twp., Highland Co. Katie M. Roads.
2296. *Sonchus arvensis* L. Field Sow-thistle. Along railroad track near New Vienna, Clinton Co. Katie M. Roads.

THE TEXANANUS (HOMOPTERA, CICADELLIDAE) SPECIES OF THE MAJESTUS GROUP WITH THE DESCRIPTION OF FOUR NEW SPECIES

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Texananus majestus O. & B. was described as a species of *Phlepsius* by Osborn and Ball in 1897[1]. The male type in the Osborn collection is from Philadelphia, Pennsylvania. In 1918 Ball[2] described *handlirschi* from Mexican specimens which he stated was "slightly smaller and with a narrower vertex" than *majestus*. The writer has not had an opportunity to examine the types of *handlirschi* nor specimens from Mexico, but specimens from Texas compared with the Ball types have been examined through the courtesy of Dr. Beamer, and the characters used for this species in the present treatment are based upon those specimens. An examination of a large number of specimens of this group from various parts of the eastern United States indicates that there are several species which have been placed under the name *majestus*. An attempt has been made, and a key provided to separate these on the basis of the male genital structures. The female genitalia are similar in type but the males offer several diagnostic characters for the separation of these species. The male pygofers each bear a distinct apical lobe which varies in different species. The male plates and styles vary in length, curvature and width. The aedeagus is composed of a ventral and dorsal portion, the dorsal portion bearing a dorso-anterior lobe which is distinctive in certain species and the ventral portion furnishes characters especially in the comparative length, width, and the structure of the branches or forked apex.

KEY TO MALES OF SPECIES OF THE *MAJESTUS* GROUP

1. Apex of each fork of ventral portion of aedeagus bifid..... **dicentrus**
1′. Apex of each fork of ventral portion of aedeagus pointed, not bifid..... 2
2(1′). Ventral eadeagus portion sharply bent ventrally and produced for more than one-third its length at apex..... **borrori**
2′. Ventral portion of aedeagus with the apical portion not sharply bent ventrally or bent portion very short..... 3
3(2′). Dorso-anterior lobe of dorsal portion of aedeagus broadened apically, constricted at base. Apical pygofer lobe broadly rounded, as broad as long, constricted at base..... **bullatus**
3′. Dorso-anterior lobe of dorsal portion of aedeagus narrowed at apex, not constricted basally. Apical pygofer lobe elongate or short, not constricted at base..... 4
4(3′). Apical pygofer lobe appearing short in lateral view, bent inwardly, not constricted basally, Apical branches of ventral aedeagus slender, elongate, in lateral view appearing bent twice..... **caducus**
4′. Apical pygofer lobes elongate, ovate, constricted at base. Apical branches of ventral aedeagus short, thick and curved ventrally..... 5
5(4′). Dorso-anterior lobe of dorsal aedeagus short, gradually broadened to base by an anterior sloping margin which extends to the basal portion of dorsal aedeagus..... **majestus**
5′. Dorso-anterior lobe of dorsal aedeagus long, rather narrow. Anterior and posterior margins almost parallel, scarcely widened basally, anterior margin not sloping to basal portion of dorsal aedeagus..... **handlirschi**

[1]Proc. Iowa Acad. Sci. 4: 229, 1897.
[2]Ann. Ent. Soc. Amer. 11: 383, 1918.

Texananus majestus (O. & B.)

P. majestus (O. & B.). Proc. Ia. Acad. Sci. 4: 229, 1897.

Male pygofers with an elongate ovate apical lobe which is constricted at base. Ventral portion of aedeagus cleft at apex forming two processes which are tapered and curved ventrally for a short distance at tip. Dorsal portion of aedeagus with a long slender apical process which curves dorsally and extends almost to dorsal wall of pygofer. A basal lobe is shorter, pointed on caudal margin and gradually broadened to base by the sloping anterior margin which reaches base of dorsal portion. The apical two-thirds of styles almost parallel margined, scarcely notched before outwardly bent, blunt apices. Plates gradually narrowed to bluntly pointed apices.

Type locality Philadelphia, Pennsylvania.

Texananus handlirschi (Ball)

P. handlirschi Ball. Anns. Ent. Soc. Amer. 11: 383, 1918.

Male pygofer lobe elongate, ovate, proportionally broader than in *majestus*. Ventral portion of aedeagus with apical processes thicker than majestus, curved ventrally. Dorsally portion of aedeagus similar to *majestus* but with dorso anterior lobe longer, more narrowed, scracely widened basally, styles distinctly notched and narrowed on outer margins near apex.

Type locality Omilteme, Mexico.

This species appears to be very similar to *majestus* in form and is more difficult to separate from it than the other species here described.

Texananus dicentrus n. sp.

Resembling *majestus* in form and coloration but with each terminus of forked aedeagus bifid at apex. Length male 8.5 mm.

Vertex angularly produced, three fifths as long at middle as width between eyes.

Color: Vertex with a pair of conspicuous spots just above apex. Transverse band between eyes interrupted at middle forming a right triangular spot on either side, with the base along median line. Pronotum with dark median vermiculate markings just back of vertex.

Genitalia: Male plates long, narrowed to bluntly rounded apices. Pygofers shorter than plates, the caudal lobe elongate and narrow. The ventral portion of the aedeagus is forked for about one-fourth of its length at apex and each branch is conspicuously bifid at apex bearing a prominent dorsal and a ventral tooth. The dorsal portion of the aedeagus composed of a long slender process which curves caudally then dorsally almost to dorsal wall of pygofer and a shorter dorsal process arising at the base and tapered to a blunt apex.

Holotype male collected at Fern Cliff, Illinois, by the author and Dr. C. O. Mohr, August 3, 1934, in the Illinois Natural History Survey Collection. This species can be distinguished from all others of this group by the bifid apices of the branched processes of the ventral portion of the aedeagus.

Texananus bullatus n. sp.

Resembling *majestus* in form and coloration but with male plates shorter than pygofers and convexly rounded and with basal lobe of dorsal portion of aedeagus broadened. Length, male 9 mm.; female 10 mm.

Vertex rather broadly, bluntly produced, more than half as long as basal width between eyes.

Color: Vertex with a pair of dark points above apex and a broad straight interrupted dark band between the eyes. Pronotum rather heavily mottled with brown.

Genitalia: Female last ventral segment rather deeply broadly emarginate either side of a pair of approximate produced median teeth separated by a deep narrow incision extending half way to the base. Male plates shorter than pygofer and almost half as broad as long. Ventral portion of aedeagus cleft for a very short distance at apex forming a pair of blunt teeth which are slightly curved ventrally. Dorsal portion of aedeagus with a long slender process curving caudally then dorsally from which arises a dorsal process at base which is rather broad forming a rounded lobe. The caudal process of the pygofer is short and broad, and broadly rounded.

Holotype male and allotype female from Jemez Springs, New Mexico, collected June 15, 1919, in the author's collection.

Texananus borrori n. sp.

Resembling *majestus* in form and coloration but with bent terminal processes of aedeagus more than one third as long as basal portion and terminal lobe of pygofer longer. Length 9.5 mm.

Vertex broadly bluntly produced, almost twice as wide between eyes as median length.

Color: Dark points on vertex above apex, faint. Transverse band dark, broad, interrupted at middle and each portion broadened at either end. The end next either eye bifid. Pronotum with the darker markings on anterior half.

Genitalia: Female last ventral segment with prominent rounded lateral angles between which the posterior margin is concavely rounded either side of a rather long, sharp, pointed tooth produced on each side of a U-shaped notch which extends half way to the base of segment.

Male plates long and slender about as long as pygofers which bear a long, rather broad caudal lobe. Ventral portion of pygofer short and robust. The apical third bent abruptly ventrally, cleft and forming two long apical, widely separated spines. The dorsal portion with a long slender curved ventral process from which arises an elongate, broader dorsal process at the base.

Holotype male and paratype male, Bellefontaine, Ohio (D. J. Borror) and a female allotype from Woodruff, Wisconsin, Sept. 3, 1916 (DeLong) in author's collection; a paratype male, from Western Springs, Illinois, collected by G. T. Reigel, August 16, 1935, in the Illinois Natural History Survey collection and one male paratype Le Seuer Co., Minnesota, July 28, 1922. (W. E. Hoffman) in the University of Minnesota collection.

I take pleasure in dedicating this species to Dr. Donald J. Borror who has collected many interesting species of leafhoppers including the holotype specimen of this species.

Texananus caducus n. sp.

Resembling *majestus* in form and coloration but with apical lobe of pygofer short, blunt and not indented dorsally or ventrally at base. Length, male 8 mm.; female 9–9.5 mm.

Vertex broadly bluntly produced, more than half as long at middle as basal width between the eyes.

Color: Vertex with the two small brown spots above apex. The transverse band on disc decidedly interrupted at middle forming a short band either side. The end next each eye is widely bifurcate, the middle portion is narrowed and the portion next the middle line is greatly enlarged caudally. Pronotum heavily infuscated on anterior margin.

Genitalia: Female last ventral segment scarcely concave between lateral angles and a slightly produced blunt tooth either side of a rather narrow U-shaped notch reaching one third the distance to the base.

Male plates long, tapered to rather narrow, rounded apices exceeding pygofers in length. Pygofers with very short rounded caudal lobes which are not constricted or notched at base. Ventral portion of aedeagus long, apical fourth bent abruptly ventrally and cleft, forming two apical processes which are more slender than basal aedeagus body and are separated. Dorsal portion with a ventral, long, curved, slender process from the base of which arises a short broader dorsal process.

Holotype male, allotype female. Ada, Oklahoma, July 16, 1937, collected by Standish and Kaiser.

Male and female paratypes, Lebanon, Okla., Hinton, Okla., and Grant, Okla., July, 1937; Clarksville, Tennessee, August, 1917 (DeLong); High Knob, Ill., October, 1934; Anvil Rock, October, 1934; Havana, Ill., Nov., 1912, and August, 1934; and Fern Cliff, Ill., August, 1934 (Frison, Ross, Mohr and DeLong).

Holotype allotype and paratypes in the author's collection. Paratypes in the Illinois Natural History Survey collection and the collection of the Oklahoma A. & M. College.

Electromagnetism

A new book dealing with the theory of electromagnetism on an intermediate level which should prove very useful to many teachers in Cullwick's "The Fundamentals of Electromagnetism." The material is contained in five chapters of which the first is devoted to the electrostatic field and the electric current; the second chapter is given over to the magnetic field and electromagnetic induction; chapter three treats the magnetic field and the electric current; chapter four deals with ferromagnetism and the final and fifth chapter contains a discussion of electromagnetic waves and the vector potential of the electric current.

The book is written in a most readable manner and the material is discussed in an interesting, if in many cases unorthodox, manner. The book is well worth owning and should prove useful as a text in intermediate courses on the subject for technical and arts students.—*H. H. Nielsen.*

The Fundamentals of Electromagnetism, by E. Geoffery Cullwick. xxvi+352 pp. New York, the Macmillan Co., 1939. $4.50.